SPACE COMMERCIALIZATION

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
SPACE SCIENCE AND APPLICATIONS

OF THE

COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

NINETY-EIGHTH CONGRESS

FIRST SESSION

MAY 3, 4, 17, 18, 1983

[No. 23]

Printed for the use of the
Committee on Science and Technology

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1983

22-870 O

22-870 O - 83 - 2

H701-78

COMMITTEE ON SCIENCE AND TECHNOLOGY

DON FUQUA, Florida, *Chairman*

ROBERT A. ROE, New Jersey
GEORGE E. BROWN, Jr., California
JAMES H. SCHEUER, New York
RICHARD L. OTTINGER, New York
TOM HARKIN, Iowa
MARILYN LLOYD, Tennessee
DOUG WALGREN, Pennsylvania
DAN GLICKMAN, Kansas
ALBERT GORE, Jr., Tennessee
ROBERT A. YOUNG, Missouri
HAROLD L. VOLKMER, Missouri
BILL NELSON, Florida
STAN LUNDINE, New York
RALPH M. HALL, Texas
DAVE McCURDY, Oklahoma
MERVYN M. DYMALLY, California
PAUL SIMON, Illinois
NORMAN Y. MINETA, California
RICHARD J. DURBIN, Illinois
MICHAEL A. ANDREWS, Texas
BUDDY MacKAY, Florida
TIM VALENTINE, North Carolina
HARRY M. REID, Nevada
ROBERT G. TORRICELLI, New Jersey
FREDERICK C. BOUCHER, Virginia

LARRY WINN, Jr., Kansas
MANUEL LUJAN, Jr., New Mexico
ROBERT S. WALKER, Pennsylvania
WILLIAM CARNEY, New York
F. JAMES SENSENBRENNER, Jr., Wisconsin
JUDD GREGG, New Hampshire
RAYMOND J. McGRATH, New York
JOE SKEEN, New Mexico
CLAUDINE SCHNEIDER, Rhode Island
BILL LOWERY, California
ROD CHANDLER, Washington
HERBERT H. BATEMAN, Virginia
SHERWOOD L. BOEHLERT, New York
ALFRED A. McCANDLESS, California
TOM LEWIS, Florida

J. H. Poore, *Executive Director*
Robert C. Ketcham, *General Counsel*
Regina A. Davis, *Administrator*
David S. Jeffery, *Minority Staff Director*

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

HAROLD L. VOLKMER, Missouri, *Chairman*

BILL NELSON, Florida
MICHAEL A. ANDREWS, Texas
GEORGE E. BROWN, Jr., California
RALPH M. HALL, Texas
MERVYN M. DYMALLY, California
NORMAN Y. MINETA, California
BUDDY MacKAY, Florida
ROBERT G. TORRICELLI, New Jersey

MANUEL LUJAN, Jr., New Mexico
BILL LOWERY, California
ROD CHANDLER, Washington
HERBERT H. BATEMAN, Virginia
ROBERT S. WALKER, Pennsylvania

CONTENTS

WITNESSES

May 3, 1983:
- Philip M. Klutznick, Chairman, National Academy of Public Administration Panel on Encouraging Business Ventures in Space Technologies, accompanied by Mitchell Rogovin, panel Vice Chairman, and Gerald J. Mossinghoff, Member ..... Page 2
- Hon. James M. Beggs, Administrator, National Aeronautics and Space Administration 26
- Daniel J. Fink, Chairman, NASA Advisory Counsel 50

May 4, 1983:
- David Hannah, Jr., Chairman of the Board, Space Services Inc. of America 60
- Charles A. Ordahl, Director of Space Programs, McDonnell Douglas Astronautics 82
- Bruce W. Ferguson, Vice President and General Counsel, Orbital Systems Corp. 92

May 17, 1983:
- Hon. Daniel K. Akaka 100
- Lt. Gen. James A. Abrahamson, Associate Administrator for Space Flight, National Aeronautics and Space Administration 127
- Herbert A. Reynolds, Deputy Director, Intelligence and Space Policy: Deputy Under Secretary of Defense, Policy 149

May 18, 1983:
- Gary Flora, Director of Commercial Titan at Martin Marietta, representing Peter B. Teets, Vice President and General Manager, Space Launch Systems Division, Martin Marietta Denver Aerospace 160
- Dr. Klaus Heiss, former President, Space Transportation Co., Inc.; and T. Allan McArtor, President and Chief Operating Officer 182
- William F. Rector III, Vice President and Director of Space Programs, General Dynamics Convair Division, accompanied by Roger Lynch, Director, Commercial Space Activities 214
- James C. Bennett, Vice President for Government Affairs, ARC Technologies, Redwood City, Calif. 230

Appendix A: Additional material submitted for the record 249
Appendix B: Comments by L. N. Cormier, president, Transpace, Inc 345
Appendix C: Legal aspects of commerical space activities 351
Appendix D: Regulation of private exterprise satellite launchings 369

SPACE COMMERCIALIZATION

TUESDAY, MAY 3, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, D.C.

The subcommittee met, pursuant to call, at 9:35 a.m., in room 2318, Rayburn House Office Building, Hon. Harold L. Volkmer (chairman of the subcommittee) presiding.

Mr. Volkmer. The Subcommittee on Space Science and Applications will come to order.

Today the subcommittee is holding the first in a series of hearings on the commercialization of space. The objective of the hearing is to acquire an understanding of the major issues associated with space commercialization. Later in the month we will focus on one particular area dealing with the potential commercialization of expendable launch vehicles. These hearings are not intended to address Earth remote sensing and weather satellite issues; these will be taken up in separate hearings arranged jointly with the Subcommittee on Natural Resources, Agricultural Research and Environment.

Following the first successful operational flights of the space shuttle, our Nation stands on the threshold of a new era in space. To move forward and capitalize on our present strengths, fresh approaches have to be taken to provide opportunities for the American free enterprise system to use space for a variety of applications and technologies. We must insure that the private sector has the freedom to organize and operate for profit in the space environment. In fact, the stated policy of the Federal Government is to encourage private sector investment in space enterprises.

This policy prompted NASA to request the National Academy of Public Administration to study issues affecting business ventures that are based on space technologies. That study has now been completed and, together with NASA's own deliberations on space commercialization, will provide the focus for today's hearing.

We would like to extend a warm welcome to our witnesses today, the first of whom is Mr. Philip Klutznick, the chairman of the NAPA Panel. Mr. Klutznick is accompanied by two members of the Panel, Mr. Mitchell Rogovin, the vice chairman, and Mr. Gerald Mossinghoff.

Following Mr. Klutznick will be Mr. James Beggs, the NASA Administrator. As the initiator of the request for the NAPA study, we look forward to Mr. Beggs' testimony both in regard to the study's recommendations and NASA's own studies of space commercialization issues.

Finally, we have invited Mr. Daniel Fink to present his views on the issues at hand. Mr. Fink's distinguished career in the private sector and his extensive knowledge of and interest in the aerospace industry will give us the benefit of another informed opinion on space commercialization issues.

At this time I would like to recognize the gentleman from New Mexico for an opening statement.

Mr. LUJAN. Thank you very much, Mr. Chairman.

We find ourselves at a crossroads, whether we let our little birds fly on their own, or whether we continue to nurture those little birds with the mother's milk of Government funds. As a matter of fact, my private preference is that we do let them fly on their own, but whether that is possible or not is the purpose of these hearings. We could use those precious funds to support some more definite tasks in the research field.

For example, even the shuttle could be commercialized. I suppose that the engineering parts or the operational parts of the program could be replaced and we could have a taxi company called the Space Shuttle Taxi Co. or whatever. First of all we have to decide what we're going to do with the shuttle—as a matter of fact, what we are going to do with the space station or whatever. So I hope that through these hearings we can come to some conclusions as to which of these technologies are ready to fly by themselves and which ones we are to keep, to nurture further along.

Thank you, Mr. Chairman. I look forward to these hearings.

Mr. VOLKMER. At this time I also wish to welcome the ranking minority member from Kansas, Mr. Winn, to the hearing, and Mr. Andrews from Texas.

Mr. Klutznick, you may proceed with your testimony. Your statement will be made a part of the record and you may either give us a resume of that statement or you may proceed with the full statement, however you so desire to proceed.

STATEMENT OF PHILIP M. KLUTZNICK, CHAIRMAN, NATIONAL ACADEMY OF PUBLIC ADMINISTRATION PANEL ON ENCOURAGING BUSINESS VENTURES IN SPACE TECHNOLOGIES; ACCOMPANIED BY MITCHELL ROGOVIN, PANEL VICE CHAIRMAN, AND GERALD J. MOSSINGHOFF, MEMBER

Mr. KLUTZNICK. Mr. Chairman, thank you. I shall give a summary of the statement.

It is a privilege to appear before you today as chairman of the National Academy of Public Administration Panel on Encouraging Business Ventures in Space Technologies. This Panel was formed in response to a request from the Administrator of the National Aeronautics and Space Administration to study and recommend policies and approaches designed to facilitate private sector involvement and investment in commercial activities in space.

Joining with me today are fellow Panel members vice chairman Mitchell Rogovin, to my left, and Gerald Mossinghoff, to my right. Also at this time I would like to acknowledge the contributions of our other Panel members: Stover Babcock, Richard Bolt, Samuel

Cohn, Emillio Daddario, Harold Finger, Peter Goldmark, John Johnson, and Thomas Paine.

Mr. Chairman, I would also call attention to the fact that we have had the understanding and participation of the president of the academy during these studies and the helpful guidance and imput of the staff members, Mr. Kloman and Mr. Voorhees.

With your permission, and as you stated, Mr. Chairman, we have already submitted for the hearing record a complete copy of the Panel's report which was presented to the Administrator of NASA yesterday. I will make some brief observations. I suggest that an opportunity be provided for my colleagues to comment as well. Thereafter, we are prepared to respond to such questions as you may wish to put.

The United States has been in the space business for approximately 25 years. During this period the Nation has developed a comprehensive space research and technology base in Government, in industry, and in our universities. Our total capabilities have been demonstrated in manned Apollo missions to the Moon, in unmanned science missions to the planets, and in meteorological, communications and other applications satellite technologies. Except for the commercial satellite communications industry, which established itself after initial NASA R&D efforts, U.S. activities in space have been characterized almost exclusively by Government objectives and Government funding.

In recent months, however, there has been an upsurge of interest in the private sector in commercial space ventures. This is evidenced by various proposals submitted to NASA and by several ventures initiated independent of NASA. We cannot catalog all the reasons for this private sector interest in space activity; it may be due in part to the advent of the space shuttle with its successful flight program offering a new and unique capability to use and explore the space environment; or it may result from an increasing awareness of profitable opportunities in and the importance of high technology enterprises. It is important to note that this interest has been paralleled abroad, particularly in Japan, France and Germany.

On the eve of this hearing, the April 19 issue of the New York Times carried a front page story in its "Business Day" section regarding the formation of the Orbital Systems Corp. by three young men 30 years of age and younger. It is stated that they borrowed their capital from banks, private investors, and financial institutions, including the Space Foundation of Houston. These entrepreneurs announced that they had "negotiated a deal with NASA to develop and market a privately finance propulsion system to boost communications satellites and other payloads from the space shuttle's low orbit to higher altitudes."

Mr. Chairman, it is too early to forecast the degree of success private ventures in space technology will achieve. Communications satellites represent a major growth industry. At this time this industry is the principal example, as I have stated, of a successful commercial application of space technology. Nevertheless, its success strongly supports the proposition that the Nation should make a coordinated effort to test the commercial potential of all space technologies and the space environment.

The Panel makes no predictions at this time as to the total benefits that might accrue from a commercialization thrust. Such estimates would be accompanied by great uncertainty. The Panel is convinced, however, that the space arena should be carefully and thoroughly examined by the business community so that, as a nation, we do not overlook an opportunity for economic benefit. Furthermore, the involvement of the private sector is essential to maintain U.S. leadership in space—an explicit national objective set forth in the National Aeronautics and Space Act of 1958. This objective was reaffirmed in the President's Space Policy Statement released July 4, 1982.

NASA has been, and for some time will continue to be, the principal generator of space technology. This role is a statutory obligation of the agency and one that has been performed extremely well. In so doing, there has been created an internal organizational philosophy and an external image that space is largely a governmental function. If the United States is to pursue the economic potential of space, NASA must play a key facilitating role, a role that is new to the agency but complementary to its continuing statutory responsibilities. These factors lead to the Panel's recommendation that there must be a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of NASA. This statement should be disseminated widely within NASA, to industry, and to the general public.

The Panel believes that a commercialization role does not diminish the NASA R&D role. It strengthens it and provides additional challenges. NASA is the basic source of space technology, space systems, and knowledge of the space environment, all of which are essential to support commercial endeavors in space. While industry excels in exploiting and marketing current technology, it often does not have the resources to undertake the high risk, long-term advanced developments necessary to maintain a leadership posture in an increasingly competitive international market.

A case in point is the advanced satellite communications program in the NASA fiscal year 1984 budget request. The Panel believes that the continuing R&D role for NASA is vital if we are to identify new opportunities such as may exist in materials processing in space, referred to normally as MPS. For example, the NASA/McDonnell Douglas, Johnson and Johnson joint endeavor in electrophoresis, an experiment on the STS-6 flight, is based upon initial research performed by NASA. MPS appears to hold a large potential for economic benefit. The Panel recommends that NASA give more attention to this activity.

In addition, Mr. Chairman, there are major facilities, perhaps best exemplified by the development of the space shuttle, that are multi-user, very expensive and technically complex, and that are critical to utilization of the space environment. These developments transcend the capabilities and needs of individual private sector firms. The Panel believes we should apply national facility precedents from the NASA aeronautical wind tunnel program to the development, utilization and operation of major facilities in space. We view the NASA R&D role and a concurrent commercialization thrust in the agency as mutually supportive for national goals and for economic benefit. The validity of this view is evidenced by the recognized benefits accruing from extensive NASA/industry collaboration in aeronautical research activities.

Most space endeavors are recognized as high risk, expensive and long lead time activities. These factors must be addressed if the private sector is to become involved. Technical risk can be reduced to more manageable levels through continuing NASA R&D activities that pursue new initiatives through technology demonstration.

The expense of experimentation in the space environment can be reduced through the use of the joint endeavor agreement. Also, NASA works closely with the insurance industry to assure available coverages for risk taking. The Panel notes the NASA awareness of these inhibiting factors and that the agency has taken positive steps to address them. Such affirmative efforts have to be made continuously. Finally, stability, consistency, and continuity of policy are essential to promote business enterprise. NASA's commercialization policies must recognize the importance of these factors and the agency must strive to minimize disruptions.

Perhaps the most difficult chore the Panel has identified to NASA is educating industry in space technologies and encouraging industry participation in commercial initiatives. Industry, particularly nonaerospace companies that daily produce goods and services for domestic and international markets, has to be made aware of the potential of space technology. Many of these firms will be exposed for the first time to the technological sophistication of space endeavors. NASA has developed innovative mechanisms—the industrial guest investigator program [IGI] and the technical exchange agreement [TEA]—to address this need.

Early familiarity with NASA R&D projects enables initial assessments of commercial potentials and enhances planning for eventual commercial applications. The Panel considers the IGI and TEA as effective approaches to this problem and their use should be expanded. In addition to these mechanisms at the technical level, it is also necessary to begin a dialog with those industry management personnel with responsibility for strategic business planning.

Mr. Chairman, organization for the commercialization activity is vital to achieving success. NASA has a challenging problem because of its program office structure and its appropriate concentration on scientific and technical objectives. This structure has been splendidly effective in producing the many NASA accomplishments. However, the Panel found a large amount of fragmentation of present commercialization activities within the agency that are counterproductive. In fact, many outsiders, and some NASA personnel, do not know where to go to discuss commercial endeavors. Therefore, the Panel recommends the establishment of a well-defined focus of responsibility at a high level in NASA to address the commercialization role.

The report identifies functions associated with this responsibility. Implicit in our recommendation, however, is a low-key approach; we are not suggesting a major reorganization of NASA. Rather, we believe it is important to clearly establish the focal point and then gradually pull together appropriate organizational elements, building a cohesive unit as the agency moves ahead with its commercialization role. The Panel does stress the need for the leadership of this activity to have business decisionmaking and marketplace experience.

In section X of the report the Panel has provided guidelines for use in processing proposals for commercial endeavors received by NASA. These were formulated in response to a specific request from the agency.

A word of caution as I conclude, Mr. Chairman. The Panel does not view its recommendations as requiring a significant infusion of Federal funds. Our recommendations are to organize for a more efficient use of existing resources. Commercialization will require a Government/industry partnership approach in which the private sector is expected to place capital at risk.

In addition to its homework, the Panel met on four occasions for a total of 6 working days to discuss these matters. During three meetings there was extensive interaction with Mr. Beggs and senior NASA officials, comprising a task force apointed for this specific purpose. Accordingly, NASA top management is quite familiar with our work and our recommendations. In one session, we met with seven entrepreneurs who are engaged in or are proposing business ventures in the commercialization of space technology to gain an understanding of their problems and their concerns.

Mr. Chairman and members of the committee, I have presented a summary of the highlights of our activity. In the event I have overlooked any significant points during this brief presentation, after my colleagues have expressed their views we would be pleased to try to respond to any questions.

Thank you, sir.

[The prepared statement of Mr. Klutznick follows:]

Not for Release Before
Presentation of Testimony

Testimony of Philip M. Klutznick
Chairman
National Academy of Public Administration Panel
on
Encouraging Business Ventures in Space Technologies
before the
Committee on Science and Technology
U.S. House of Representatives

May 3, 1983

Mr. Chairman and Members of the Subcommittee:

It is a privilege to appear before you today as Chairman of the National Academy of Public Administration Panel on Encouraging Business Ventures in Space Technologies. This Panel was formed in response to a request from the Administrator of the National Aeronautics and Space Administration (NASA) to study and recommend policies and approaches designed to facilitate private sector involvement and investment in commercial activities in space. Joining with me today are fellow Panel members Vice Chairman Mitchell Rogovin, and Gerald Mossinghoff. Also at this time I would like to acknowledge the contributions of our other Panel members: Stover Babcock, Richard Bolt, Samuel Cohn, Emilio Daddario, Harold Finger, Peter Goldmark, John Johnson, and Thomas Paine. (Biographic data are attached.)

Mr. Chairman, with your permission I submit for the hearing record a complete copy of the Panel's report which was presented to the Administrator on May 2, 1983. I will make some brief observations. I suggest that an opportunity be provided for my colleagues to comment. Thereafter, we are prepared to respond to your questions.

The United States has been in the space business for approximately twenty-five years. During this period the nation has developed a comprehensive space research and technology base in government, in industry and in our universities. Our total capabilities have been demonstrated in manned Apollo missions to the moon, in unmanned science missions to the planets and in meteorological, communications and other applications satellite technologies. Except for the commercial satellite communications industry which established itself after initial NASA R&D efforts, U.S. activities in space have been characterized almost exclusively by government objectives and government funding. In recent months, however, there has been an upsurge of interest in the private sector in commercial space ventures. This is evidenced by various proposals submitted to NASA and by several ventures initiated independent of NASA. We cannot catalogue all the reasons for this private sector interest in space activity; it may be due in part to the advent of the space shuttle with its successful flight program offering a new and unique capability to use and explore the space environment, or it may result from an increasing awareness of profitable opportunities in and the importance of high technology enterprises. This interest has parallels abroad, particularly in Japan, France and Germany.

On the eve of this hearing, the April 19th issue of the New York Times carried a front page story in its "Business Day" section regarding the formation of the Orbital Systems Corporation by three young men 30 years of age and younger. It is stated that they borrowed their capital from banks, private investors and financial institutions, including the Space Foundation of Houston. These entreprenuers announced that they had "negotiated a deal with NASA to develop and market a privately financed propulsion system to boost communications satellites and other payloads from the space shuttle's low orbit to higher altitudes."

Mr. Chairman, it is too early to forecast the degree of success private ventures in space technology will achieve. Communications satellites represent a major growth industry. At this time this industry is the principal example of a successful commercial application of space technology. Nevertheless, its success strongly supports the proposition that the nation should make a coordinated effort to test the commercial potential of all space technologies and the space environment. The Panel makes no predictions as to the total benefits that might accrue from a commercialization thrust. Such estimates would be accompanied by great uncertainty. The Panel is convinced, however, that the space arena should be carefully and thoroughly examined by the business community so that, as a nation, we do not overlook an opportunity for economic benefit. Furthermore, the involvement of the private sector is essential to maintain U.S. leadership in space - - an explicit national objective set forth in the National Aeronautics and Space Act of 1958. This objective was reaffirmed in the President's Space Policy Statement released July 4, 1982.

NASA has been and for some time will continue to be the principal generator of space technology. This role is a statutory obligation of the agency and one that has been performed extremely well. In so doing, there has been created an internal organizational philosophy and an external image that space is largely a governmental function. If the United States is to pursue the economic potential of space, NASA must play a key facilitating role — a role that is new to the agency but complementary to its continuing statutory responsibilities. These factors, lead to the Panel's recommendation that there must be a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of NASA. This statement should be disseminated widely within NASA, to industry and to the general public.

The Panel believes that a commercialization role does not diminish the NASA R&D role; it strengthens it and provides additional challenges. NASA is the basic source of space technology, space systems, and knowledge of the space environment, all of which are essential to support commercial endeavors in space. While industry excels in exploiting and marketing current technology, it often does not have the resources to undertake the high risk, long term advanced developments necessary to maintain a leadership posture in an increasingly competitive international market. A case in point is the advanced satellite communications program in the NASA FY-1984 budget request. The Panel believes that the continuing R&D role for NASA is vital if we are to identify new opportunities such as may exist in materials processing in space (MPS). For example, the NASA/McDonnell Douglas/Johnson and Johnson joint endeavor in electrophoresis, an experiment on the STS-6 flight, is based upon initial research performed by NASA. MPS appears to hold a large potential for economic benefit. The Panel recommends that NASA give more attention to this activity.

In addition, Mr. Chairman, there are major facilities, perhaps best exemplified by the development of the space shuttle, that are multi-user, very expensive and technically complex, and that are critical to utilization of the space environment. These developments transcend the capabilities and needs of individual private sector firms. The Panel believes we should apply national facility precedents from the NASA aeronautical wind tunnel program to the development, utilization and operation of major facilities in space. We view the NASA R&D role and a concurrent commercialization thrust in the agency as mutually supportive for national goals and for economic benefit. The validity of this view is evidenced by the recognized benefits accruing from extensive NASA/industry collaboration in aeronautical research activities.

Most space endeavors are recognized as high risk, expensive and long lead time activities. These factors must be addressed if the private sector is to become involved. Technical risk can be reduced to more manageable levels through continuing NASA R&D activities that pursue new initiatives through technology demonstration. The expense of experimentation in the space environment can be reduced through the use of the joint endeavor agreement.

Also, NASA works closely with the insurance industry to assure available coverages for risk taking. The Panel notes the NASA awareness of these inhibiting factors and that the agency has taken positive steps to address them. Such affirmative efforts have to be made continously. Finally, stability, consistency and continuity of policy are essential to promote business enterprise. NASA's commercialization policies must recognize the importance of these factors and the agency must strive to minimize disruptions.

Perhaps the most difficult chore the Panel has identified to NASA is educating industry in space technologies and encouraging industry participation in commercial initiatives. Industry, particularly non-aerospace companies that daily produce goods and services for domestic and international markets, has to be made aware of the potential of space technology. Many of these firms will be exposed for the first time to the technological sophistication of space endeavors. NASA has developed innovative mechanisms - the industrial guest investigator program (IGI) and the technical exchange agreement (TEA) to address this need. Early familiarity with NASA R&D projects enables initial assessments of commercial potentials and enhances planning for eventual commercial applications. The Panel considers the IGI and TEA as effective approaches to this problem and their use should be expanded. In addition to these mechanisms at the technical level, it is also necessary to begin a dialogue with those industry management personnel with responsibility for strategic business planning.

Mr. Chairman, organization for the commercialization activity is vital to achieving success. NASA has a challenging problem because of its program office structure and its appropriate concentration on scientific and technical objectives. This structure has been splendidly effective in producing the many NASA accomplishments. However, the Panel found a large amount of fragmentation of present commercialization activities within the agency that are counterproductive. In fact, many outsiders, and some NASA personnel, do not know where to go to discuss commercial endeavors. Therefore, the Panel recommends the establishment of a well defined focus of responsibility at a high level in NASA to address the commercialization role. The report identifies functions associated with this responsibility. Implicit in our recommendation, however, is a low key approach; we are not suggesting a major reorganization of NASA. Rather we believe it is important to clearly establish the focal point and then gradually pull together appropriate organizational elements, building a cohesive unit as the agency moves ahead with its commercialization role. The Panel does stress the need for the leadership of this activity to have business decision-making and marketplace experience.

In Section X of the report the Panel has provided guidelines for use in processing proposals for commercial endeavors received by NASA. These were formulated in response to a specific request from the agency.

A word of caution as I conclude, Mr. Chairman. The Panel does not view its recommendations as requiring a significant infusion of federal funds. Our recommendations are to organize for a more efficient use of existing resources. Commercialization will require a government/industry partnership approach in which the private sector is expected to place capital at risk.

In addition to its homework, the Panel met on four occasions for a total of six working days to discuss these matters. During three meetings, there was extensive interaction with Mr. Beggs and senior NASA officials comprising a task force appointed for this specific purpose. Accordingly, NASA top management is quite familiar with our work and our recommendations. In one session, we met with seven entrepreneurs who are engaged in or are proposing business ventures in the commercialization of space technology to gain an understanding of their problems and concerns.

Mr. Chairman, I have presented a summary of the highlights of our activity. In the event I have overlooked any significant points during this brief presentation, after my colleagues have expressed their views we would be pleased to try to respond to any questions.

Thank you.

Panel on Encouraging Business Ventures in Space Technologies

Stover L. Babcock, Jr., Vice President of Tucker Anthony and R. L. Day, New York; formerly Vice President, Merrill Lynch, Pierce, Fenner & Smith; ten years of prior experience in corporate finance, marketing and strategic business development.

Richard H. Bolt, Chairman, Bolt Beranek and Newman Inc., Cambridge, MA, 1953-76, Emeritus; Professor of Acoustics and other positions, Massachusetts Institute of Technology, 1939-70; Associate Director, NSF, 1960-63; Principal Consultant, biophysical science, NIH, 1957-60.

Samuel M. Cohn, Vice President, Robert R. Nathan Associates, Washington, D. C.; Chief Economist, Chief of Fiscal Analysis, Deputy Assistant Director for Budget Review, Bureau of the Budget, 1947-66; Assistant Director, Office of Management and Budget, 1966-73. *

Emilio Q. Daddario, Attorney-at-law, Wilkes, Artis, Hedrick and Lane, Washington, D. C.; Member, United States House of Representatives, 1959-71; Director, Office of Technology Assessment, U.S. Congress, 1973-77. *

Harold B. Finger, President and Chief Executive Officer, U.S. Committee for Energy Awareness, Washington, D.C.; Associate Administrator for Organization and Management, NASA, 1967-69; Assistant Secretary for Research and Technology, HUD, 1969-72; Staff Executive, General Electric Company, 1972-83. *

Peter C. Goldmark, Jr., Executive Director, The Port Authority of New York and New Jersey; Executive Assistant to the Mayor of New York, 1970; Secretary of Human Services, Massachusetts, 1971-75; Director of the Budget, State of New York, 1975-77. *

John A. Johnson, consultant, Washington, D. C.; General Counsel, NASA, 1958-63; Vice President, international, COMSAT, 1964-73; President, and Chairman COMSAT General Corp. 1973-80; Chairman, Satellite Television Corp., 1980-81.

Philip M. Klutznick, (Chairman) Senior Partner, Klutznick Investments, Chicago; former limited partner, Salomon Bros.; member U.S. delegations to United Nations, 1957, 1961, 1962 with rank of ambassador; U.S. Secretary of Commerce, 1979-80. *

Gerald J. Mossinghoff, U.S. Commissioner of Patents and Trade Marks; Deputy Director Legislative Affairs; and staff positions in Office of General Counsel leading to position of Deputy General Counsel, NASA, 1978-81.

Mitchell Rogovin, (Vice-Chairman) Senior partner, Rogovin, Stern and Huge, Washington, D. C.; Assistant Attorney General of U.S., 1966-69; partner, Arnold and Porter, 1969 - 76; Special Counsel to the Director of Central Intelligence, 1975-76. *

Thomas O. Paine, Thomas O. Paine, Associates, Los Angeles; Deputy Administrator, then Administrator, NASA, 1968-70; Senior Vice President, General Electric, 1970-76; President, Northrop Corp. 1976-79.

* Academy Member

Mr. VOLKMER. Thank you very much, Mr. Klutznick.

We will now proceed with questioning under the 5-minute rule, and I will recognize the gentleman from New Mexico.

Mr. LUJAN. Thank you very much, Mr. Chairman.

The entire presentation deals with and, as a matter of fact, supports the involvement of the private sector as essential to maintaining the U.S. leadership in space. You do make a statement on page 3 that:

> There must be a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of NASA.

Do you find within NASA, in the overall structure—I am not just talking about the upper levels—an eagerness or a reluctance to turning over entire projects to the private sector?

Mr. KLUTZNICK. I can only answer that in a reasonably general way. It is very hard to judge the motives of people or their inclinations—but you can tell by acts. To me, at least, sitting on the Panel, I was somewhat impressed by the seven entrepreneurs with whom we met. We put specific questions of that character to them, and the answers generally were that they found NASA cooperative in the treatment of their problems.

I must add, however, as one who has been in government and out of government a bit, that we have said—and I would reiterate—that NASA at this stage has not yet put itself together in a manner that would ease the approach to commercial ventures. But under the circumstances, I think they have done quite well.

Mr. LUJAN. That being the case, what kind of a government structure do you see that we should develop to encourage business ventures in space?

Mr. KLUTZNICK. Well, we had considerable discussion on that and concluded that the Panel should not make a specific recommendation because the Panel itself is not fully aware of the strengths and the weaknesses of some of the personnel who are involved.

We have, however, suggested in the report and in my statement that it does not call for a major reorganization of any kind. What it really calls for is lifting the activity to as close a position to the Administrator as possible, giving it complete public attention, and staffing it with some additional people, or maybe people that are in the agency—we don't know the background of all the people—who understand the private marketplace and who understand commercial opportunities.

After all, as we have said and enlarged on, NASA's role as it was originally put forth, and as it must continue to a high degree, is in the technical and scientific area. People who are qualified in that respect adequately are not necessarily qualified to understand the problem of the private entrepreneur.

So I would say and repeat what the report says, that by a proper placement at a proper level within the agency, and a drawing together of the strengths that they now have, and a complete public knowledge of their availability, that at this stage that would be adequate. What might happen as the activity grows much larger—and I anticipate it will—remains to be seen.

Mr. **Lujan**. We have been told, for example, that in order to fire off a rocket, that you have to go around through the entire Federal Government, practically every agency—and that's overstating it, I know, but we usually do that when we're trying to make a point—that you must go through several different agencies in order to attain the various permits that you need. That seems to be an area where we could simplify the process to some degree.

Mr. **Klutznick**. We have commented on that, Congressman, in our report.

Mr. **Lujan**. In regard to the cooperation that these entrepreneurs talked about as far as NASA was concerned. Was it of the type: "you take over this entire project" or "we will furnish space for your experiment," like electrophoresis and those kinds of things? Or did you get that deep into it?

Mr. **Klutznick**. One must be very careful to reach general conclusions from seven instances. We faced up to seven entrepreneurs who were either eager to get in or were ready to get in to commercialization. I cannot do anything more than generalize in response to that, to say that the atmosphere was right. I would have to add that the organizational structure at this stage is not right and we have suggested this modest change so that there would be a central point of call for a lot of it.

As far as getting on to the shuttle, I guess that is going to have to be a privilege for a long time to come. I haven't been able to——

Mr. **Lujan**. I understand that, and I was using that as an example of one that we cannot turn over because, as a matter of fact, we are not at that point.

Mr. **Klutznick**. We have said that in our report, that we don't think the shuttle has yet reached the stage of development and is as completely ready for a turnover as one might wish. As a matter of fact, perhaps a greater need is to complete the fleet and to learn a lot more before it could be turned over, if it is ever turned over. But we recommended that it ought to be reviewed constantly as the progress goes forward.

Mr. **Lujan**. Concerning a couple of projects, what were your recommendations on Landsat and Medsat?

Mr. **Klutznick**. This did not come to our attention—it did come to our attention in the press. As a matter of fact, we have no recommendation. It is not within our jurisdiction.

Mr. **Lujan**. Thank you.

Thank you, Mr. Chairman.

Mr. **Volkmer**. The Chair will now recognize the gentleman from Texas, Mr. Andrews.

Mr. **Andrews**. Thank you, Mr. Chairman.

In certain aeronautical research programs, NASA conducts the R&D and private industry provides hardware and flight testing. Is this a kind of commercialization model that you think would work in the future?

Mr. **Klutznick**. Well, I think it is dangerous to look too far into the future in any event. At the present, and in the foreseeable future, the character of progress that is needed if we are to stay ahead in the world—and that is of utmost importance, in my judgment and the judgment of the Panel—is to continue to have vested in NASA the R&D responsibility that will enable it to explore new opportunities and increasingly rely for execution and implementation, to the extent possible, on the private sector. That has been a partnership that has worked in a number of instances.

The day may come, and it may not be too far away or close at hand, that the product of creativity may come, in part or in whole, from the private sector. I don't think we are anywhere near that point yet.

Mr. **ANDREWS**. Should we have, for instance, greater tax incentives for private industry to get involved?

Mr. **KLUTZNICK**. Well, we went into that question, and perhaps on the whole question of tax incentives I will call on Mr. Rogovin.

Mr. **ROGOVIN**. Congressman, we were of the mind that this industry is no different than American industry across the board. There is great need for research and development; there is great need for those incentives that are currently available in the tax law. So we concluded that the space industry would stand shoulder to shoulder with the rest of American industry and that there was nothing special that ought to be carved out for the space industry that isn't either currently available or should be available for the rest of American industry.

Mr. **ANDREWS**. There are some special things, though. I mean, as we transfer this public knowledge that NASA has developed to the private sector, how do we set up a structure, for instance, where we prevent a monopoly, prevent one private company cornering the market on some of this valuable information that NASA has achieved?

Mr. **KLUTZNICK**. Well, in terms of technical questions, my colleague, Mr. Mossinghoff, who is engaged in that problem all the time, will comment.

In terms of monopoly, which we fear, sometimes the very nature of things produces a natural monopoly and one has to remember we have a number of laws that defend the country and the people from monopolies that are harmful. But I would rather have Mr. Mossinghoff comment on that.

Mr. **MOSSINGHOFF**. Congressman, I think the answer has two aspects. First, if what the agency does looks in any way like a concession on their part, if what they do takes on the nature of a concession, it seems to me that the agency would want to get certain assurances that the concessionary rights would be available generally to people.

On the other hand, if what they do is like the Johnson & Johnson/McDonnell Douglas experiment, then, I think, given the enormous investment on the private side, then the pattern established in the joint endeavor agreement where they do get patent rights and rights to technical data coming out of those experiments they fund, they do get those rights as long as they continue to pursue the experiment. I think the joint endeavor agreement was a very well tailored agreement along those lines because it did recognize the $100 million-plus investment that was going to be made on the private side and, as long as they pursue the inventions and the experiments, they do have total rights to them. I think that is appropriate.

Mr. **ANDREWS**. Thank you.

Thank you, Mr. Chairman.

Mr. VOLKMER. The Chair will now recognize Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman.

This week's U.S. News & World Report is a 50th anniversary issue and they're looking at the next 50 years. One statement in there that particularly interested me comes from Brian O'Leary, who is an astronomer and a former astronaut. He says in there, "We are on the verge of a second Copernican revolution. We will be able to draw a new kind of wealth from the energy and materials available in space."

Is there any chance that can be done without substantial commercialization, based upon the study that you did?

Mr. KLUTZNICK. Well, actually the whole bent of our study is to suggest that, unless there is growing commercialization, extensive commercialization, we will not recognize the maximum that is available out of this enormous new field. That is our conclusion.

Mr. WALKER. Well, that leads me then to a couple of questions.

Do you think it would be helpful to amend NASA's organic act, to state that one of the purposes of the agency should be to move technology into commercialization?

Mr. KLUTZNICK. Well, our report suggests that the application and the involvement of the private sector was stated, and the President, as late as 1982, reiterated that. Now, whether or not the act should be amended, we didn't go into that.

Mr. WALKER. The agency, in its organic act, is given a great deal of R&D authority. There is really no authority specified among the purposes of the agency for commercialization.

I guess my question is, given where your report says we have obviously got to go, wouldn't it be somewhat helpful to begin with the idea that one of the purposes of NASA is to promote commercialization?

Mr. KLUTZNICK. Well, I have not worked with the act. Mr. Beggs has, and he will be testifying. I think he can answer that question better than I can.

Mr. Mossinghoff, would you like to comment on that?

Mr. MOSSINGHOFF. Yes, I would. The Space Act itself, I guess written 25 years ago, is a marvelous example of a forward-looking act. It seems to me, even though there is no specific reference to commercialization in the Space Act, there are several purposes—leadership of the United States, the widest practical dissemination coming from NASA's programs—there are several areas in the act where clearly the act envisioned the kinds of activities that are recommended in the Panel's report. Again, I will defer with my chairman on whether there should be amendments specifically directed to this area.

Mr. WALKER. Did you take a look at all at the impact of congressional decisions on commercialization? Obviously you looked to a large extent at the agency, at NASA, and what its impact has been and what the lack of organization there has done to impede commercialization and what should be done to change that.

Did you look at all at what the impact of the legislative body has been? From that standpoint, where I'm coming from, it seems to me that there is a kind of intransigence here as well. Much of what has taken place in space activities up to now has taken place because of the power wielded by this committee, by similar committees in the Senate, and there is a reluctance by some to give up that kind of power to the private sector in the future.

I am wondering if you took a look at that and looked at whether or not Congress has impeded commercialization and whether or not there's a threat of us impeding commercialization in the future.

Mr. KLUTZNICK. No, we did not look at that specifically, but as one who has lived in Government and out of Government, over a period of years, you can get both sides of that argument from almost anybody. But finally, the Congress has to pass the law based upon its knowledge. I think it is the obligation of the agency that is involved in handling the business in the public sector to keep the Congress fully informed and to make the best case it can, and for the public to be aware and make the best case it can.

But, I don't think it would be proper for a group of citizens to take one step at a time and try to evaluate whether the Congress has been derelict or not. We didn't have that assignment.

Mr. WALKER. I think it is important, though, for Congress to be aware that it has the potential of stopping some of these things from happening, too. For instance, we have had suggestions already in this committee of setting up basically hoops through which everyone would have to jump if they were going to commercialize any part of outer space, or if the Government is going to spin off programs that have the potential for commercialization.

It seems to me that the character of those hoops could very well determine whether or not there is going to be commercialization or whether there is not. If we set up a fairly easy process for commercialization, we will probably help inspire it. If we set up a very difficult process, we will probably impede it for heaven knows how long. I think you have very definitely a variety of opinion within this committee and within the Congress as to just how difficult we ought to make the process of commercialization. I would hope at least at some point that some of the people who are familiar with the topic and have looked at it would come back and tell Congress just what we should be doing to make sure we don't stand in the way of commercialization as well.

I was also interested in your comments with regard to the space shuttle. One of the things that it seems to me we have as a potential for getting an increased fleet of space shuttles is to go with one of the proposals for a private buy of a shuttle, or private investment in the shuttle program, with the potential then of a payload capacity being devoted to those private sector investments.

You seem to be saying that that would not be a good idea to go along with. Did I hear you correctly?

Mr. KLUTZNICK. Well, you heard part of what I said. The other part was that we felt, while this precise moment was not right for stopping the work on the shuttle and transferring it to commercialization, we think it should be kept under constant review against the time when it would be right.

Mr. WALKER. Let me give you a bottom line question. If it is a question of buying the fifth orbiter or not buying the fifth orbiter because we have a private investment potential, should we not buy the fifth orbiter because that would put us immediately into private investment in the shuttle program? That is a decision that is probably going to have to be made this year or next.

Mr. **Klutznick**. We did not go into that question in detail. We would encourage the completion of the fleet, of course. You are quite right, that Congress has it in its power in almost any activity to impede it or advance it, and that is a judgment that Congress has to make. But that decision should only be made when the facts are clear, and we didn't find any such statement of that.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Volkmer**. The Chair recognizes the gentleman from Washington.

Mr. **Chandler**. No questions, Mr. Chairman.

Mr. **Volkmer**. The gentleman from Virginia, Mr. Bateman.

Mr. **Bateman**. No questions.

Mr. **Volkmer**. I have a few questions. I would first wish to commend the full Panel for their report. I reviewed it last night. I'm afraid I have more questions than we can get done in 5 minutes, but maybe we can get some of them done anyway.

You addressed part of this in your statement, Mr. Klutznick, on the question of having a high level NASA person to address the commercialization role. Did you address at all, in the organizational structure of NASA, where that type of person would fit?

Mr. **Klutznick**. Well, we tried to avoid pinpointing a decision which depends upon a knowledge of personnel and activity within the organization, that in the time we had we had neither the time to get at it, nor was that our role. But from personal experience in the Department of Commerce, I would say that role would have to be close to the throne, very close to the throne.

Mr. **Volkmer**. I believe you emphasized, too, in your statement the need for leadership in this activity to have business decision-making and marketplace experience. You want somebody that has been in the business community; is that correct?

Mr. **Klutznick**. That is correct. He has to have a knowledge of what makes the private sector tick.

Mr. **Volkmer**. Also in the commercialization feature, if I remember reading in the report, can you elaborate at all on how we bring in people who are not within the aerospace or aeronautics field at this time? As I understand the report, people in aerospace are basically the ones that are examining the commercialization of space activities because they're the only ones familiar with the problems.

Mr. **Klutznick**. Mr. Chairman, that is the core of the problem, in a sense. If this commercialization is to be completely successful, first of all we must not think only in terms of large technologies or requiring large companies to make it operate. There already has been, from the work of NASA—and we make that point very clear—a fallout of technology that had nothing to do with traveling to outer space. Computerization has changed constantly under the pressure, and there are small- and medium-sized companies that can take a piece of technology that is available as a result of the experience of NASA and fly with it, as it will, in a field that has nothing to do with going out to outer space. This has been one of our problems generally in commerce, that we have not grasped the opportunities of the creativity which this country has led the world in, and others have taken it and used it.

Now, how do you do it? You do it as you promote anything else, Mr. Chairman. You bring these people in. I understand NASA is contemplating some such activity in that regard, to make them aware of opportunity. You make them a part of the ongoing experience.

Most people that you will talk to in the street, and some of my good friends in business, say to me "You mean there really is an opportunity there?" They don't know it. Therefore, the agency has to have kind of a knowledge-building base that it transfers to small- and medium-sized and large-businesses. This should be an ongoing activity.

Mr. VOLKMER. Did you look at all at the technology utilization sector within NASA that they presently have?

Mr. KLUTZNICK. We didn't look at it in that respect. Perhaps Mr. Mossinghoff would have a more intelligent comment on that.

Mr. MOSSINGHOFF. A number of us are generally aware of the work that goes on in the technology utilization program, but we really, in this Panel activity, focused on activities and business ventures in space as opposed to the spinoff use of space-related technology in commercial products.

Mr. VOLKMER. As I understand it also, the report does bascially support the commercialization of expendable launch vehicles on the premise that instead of detracting from the shuttle operations in the future, it would actually be competitive against the Ariane and also bring down the price for use of the shuttle; is that correct?

Mr. KLUTZNICK. Yes. Generally, Mr. Chairman, I think we ought to make it clear that NASA itself is phasing out that phase of its work. We think it would be sad to let it drop completely when there is commercial interest. It would keep our competitive position stronger as against the international market.

Mr. VOLKMER. I also read with interest the basis that you have for evaluation of NASA assets to determine the cost for commercialization, or a spinoff of those, either through lease or sale or what have you. Thus, the Panel concludes that once program objectives have been achieved, or a facility has served its intended purpose, the Nation has received full value of its expenditures. At that point the Panel believes the Federal Government's estimate of the currently remaining value of its assets should be determined by their worth in the marketplace, not by what the historical costs may have been to produce them.

Are you saying they are basically marketplace by a bidding procedure, or how do we determine the market value of, let's say, a launch platform that NASA no longer needs but could be used in the private sector? How would we determine the value of a NASA launch platform?

Mr. KLUTZNICK. First of all, the best determination, if there is a market, is market value. Once NASA——

Mr. VOLKMER. But we have never sold one of these before, so I'm trying to get some help.

Mr. KLUTZNICK. I'm going to try to give you some help, if I can.

No. 1, any sale of anything that the Government owns, where there is not a fixed going market, the Government has one of two choices: it can take what it no longer needs and junk it, or it can put it up for bids and sell it to the best bidder. Junking it may be cheap in some cases. In that respect the Government, when it creates things, is no different than the private entrepreneur. Keeping something that you can't use is costly; therefore, you try to get the best price you can.

As a public institution, I would recommend that the market be probed in the normal way. Establish your bidding standards and go to the market and see what it will bring.

Now, it is better for the Government to get what it can than to carry a load and continue to come to the Congress for appropriations to keep it. On the other hand, there will be such uses—to take a launch pad or something of that sort—that may have been succeeded by a better product, but still has some commercial value in it. Again, you offer it for sale and the market will take it. It won't be what it cost to produce it, unless we have had inflation to a point where inflation offsets it. It will probably be below, and maybe materially below the cost of production in many instances when there has been no inflation. That still is in the public interest, to dispose of it and get the maximum usability out of it.

But that is almost something that you have to handle on a case-by-case basis and not keep any secrets from the public as to what you're doing, or from the Congress, either.

Mr. VOLKMER. Let's take expendable launch vehicles, or the external tank at Martin Marietta. I assume the Government has gone into the cost of large tools to make parts of these items and we do not amortize or depreciate those items. Would you say that these costs should be included in determining a market value on those type of items in the event those Government-owned tooling or buildings, et cetera, are to be sold?

Mr. KLUTZNICK. Well, I have been in local government, State government and Federal Government. When you have got something you no longer need, the best practice is to offer it to the public for sale, if there is any commercial value in it. The marketplace will determine if there is. If there are no bids, you may have no alternative but to junk it.

Mr. VOLKMER. What if there is only one?

Mr. KLUTZNICK. If there is one, then if I were the administrator I might order a rebidding or I might consult with the best experts I could and determine whether that is as fair a price as you can get. But that's an administrative decision largely based upon the legal structure of our Government.

Mr. VOLKMER. One other area that I would like to get into—there are others, but one specifically. You mentioned that you do not believe NASA should be the lead agency in the commercialization sector in the report; is that correct?

What I mean is, if there is any type of licensing or regulation or procedural——

Mr. KLUTZNICK. No, quite the contrary. We take the position, because of its knowledge, and because of its background, at this stage in the development, you could probably not have successful commercialization without NASA being right up at the top in the game. Who else would the people go to?

Mr. VOLKMER. Maybe I misread. As far as what I was trying to get at, in the event that we pass legislation setting out the procedure and regulation for operation of commercial spacecraft, et cetera——

Mr. Klutznick. That's a different question. Regulation, we do say we don't think they should have the lead role because there might be a conflict of interest. But in commercialization, it is quite the opposite.

Mr. Volkmer. There has been at least one piece of legislation introduced in the commercialization for the ELV's, providing for the Department of Commerce to be the agency that would handle that type of activity and regulate that type of activity. Do you have any comment on that?

Mr. Klutznick. Well, as an alumnus, I am reluctant to express my feelings on that subject. Perhaps I will leave it to Mr. Rogovin. I am prejudiced.

Mr. Volkmer. Is there anyone else who would like to comment on that?

Mr. Mossinghoff. As a current official of the Department of Commerce, I also will defer to Mr. Rogovin on this. [Laughter.]

Mr. Rogovin. Well, to tell you I represented the CIA and that's where it should go would make a mockery of these hearings. [Laughter.]

Mr. Volkmer. We'll just have to make that decision when the time comes.

Mr. Klutznick. That's correct.

Mr. Volkmer. I may have some additional questions that I may like to submit in writing, if that is all right Mr. Klutznick. Time is short.

I understand the gentleman from New Mexico has some additional questions.

Mr. Lujan. I have a question, but there is something that I just can't let go by. Monetary value isn't the only criterion that you should use in keeping something, and I am sure NASA will understand what I'm talking about. Basically, it is the saving of the launch tower, that we just don't look at money but we look at other factors, whether it is good for support of the program or for tourism and those kinds of things.

Mr. Klutznick. Congressman, I think if you will read the report carefully you will find that is the way we look at it, too.

Mr. Lujan. I know, but that's where the conversation was leading to and I just didn't want it to go by, not that it's of significant importance at the hearing.

The one question that I did have, you say you talked to seven entrepreneurs. Of course, we know about the electrophoresis—at least I do, and the whole committee does—and about work in alloys.

What other sorts of things were people interested in? Are you at liberty to say what kind of projects those seven people had in mind specifically?

Mr. Klutznick. I think I am going to let Jerry finish with it, but I called attention to one that was announced in the New York Times, and that was presented to us actually at the meeting of the seven. But your recollection may be better on that than mine.

Mr. Mossinghoff. The entrepreneurs were generally working in one of three areas—either in doing experiments like electrophoresis, materials processing in space, or developing upper stages for use in the shuttle for high energy orbits, or actually taking over expendable launch vehicles. I think that covers the three areas——

Mr. **Rogovin**. The service activities.

Mr. **Mossinghoff**. Preparing payloads at the cape or wherever else in terms of checkout and so on.

Mr. **Klutznick**. Remoting sensing was also included. But some of these were in the preliminary stage. Others were advanced to the point where the orbital company has now secured the financing and is now going forward as a booster company.

Mr. **Lujan**. Well, the servicing aspects of it are on the road——

Mr. **Klutznick**. Yes. That has been there. I think it will increase as time goes on, as it is demonstrated that it is profitable to do it that way.

Mr. **Lujan**. Thank you very much.

Mr. **Volkmer**. One other question. I notice that in your statement and in the report, also, you congratulate NASA on the Joint Endeavor Agreement. In your report the statement is "The Panel recommends more emphasis on all aspects of NASA's material processing program, inasmuch as it appears to hold large potential for commercialization."

Again, how do you feel that NASA should emphasize this?

Mr. **Klutznick**. We think they have established, through their joint agreement, the possibility. We have also said here they emphasize it by giving potential contractors access to outer space, by getting a ride on the shuttle, if necessary—not on the rocket; that would be a mistake.

More and more, if you get a centralized focus on commercialization, you will have a place where things come to you and where ideas generate out of NASA. We said MPS, for example, materials processing. Only in recent days there has been a publication which has carried an article on the possibilities, including the possibility of getting a diabetes cure in one shot out of a process that would have to take place in a low gravity area. So these things are building up, Mr. Chairman.

The important thing is that there be a mutual exchange and acceptability between the private entrepreneur that has will and a NASA that is willing to help, as well as a NASA that can create ideas itself in its focal point that might be called to the attention of the public sector. We are having some people in from private enterprise at lunch today, in which we are going to discuss some of the possibilities. My understanding is there will be a meeting held of a larger kind at the next lauching, where industry will be called in and opportunities will be explained to them. It's a promotional activity, Mr. Chairman, both ways.

Mr. **Volkmer**. Now, in your report also you provide that NASA should continue, of course, with research and development—no question about that. Specifically, I would like to ask, once a technology has been commercialized, should the Government, NASA, continue to fund research in that area?

Mr. **Klutznick**. I think it would depend entirely on the character of commercialization.

Mr. **Volkmer**. We are seeing it now in communications, and you point that out in your report, on the ACTS program.

Mr. **Klutznick**. There might be exceptions to the rule, but they should quit. One can't foresee that, don't you agree?

Mr. **Mossinghoff**. I agree with that.

Mr. **Klutznick**. You must not have a hard and fast rule that would prohibit the one agency we have that can take high risk experiments and let it dry up. There are a lot of other industries that we have today that might have profited from a little help in that connection.

Mr. **Volkmer**. Does anyone else have any further questions? All right. Thank you very much, Mr. Klutznick. Again, I wish to commend you on your report. We will take the matters in regard to antitrust, patents, the questions of insurance, all these things. I appreciate very much the statement and your report.

Mr. **Klutznick**. We hope it will be helpful to the committee.

Mr. **Volkmer**. I am sure it will. Thank you very much.

We will now hear from the Administrator of the National Aeronautics and Space Administration, the Honorable James Beggs.

You may proceed, Mr. Beggs. Your statement will be made a part of the record. You may either give us a résumé of it or review the whole statement, however you so desire.

STATEMENT OF HON. JAMES M. BEGGS, ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. **Beggs**. If I may give a summary, Mr. Chairman, I will be very brief.

Mr. Chairman and members of the subcommittee, it is a special pleasure for me to appear before the subcommittee. The questions that are being addressed today are no longer a question of whether space has commercial promise but, rather, how best to proceed to maximize that promise for national economic well-being. I think that is a very significant point in the history of this Agency and the history of this Nation.

What we hope to do in the coming decade or so is to be able to encourage private industry to form the same kind of partnership that NASA has had with the aeronautics industry over the past, really, 67 years since the NASA was created. It can be, I believe, equally beneficial to the country.

As the President said in his Fourth of July national space policy statement, he encourages the domestic commercial exploitation of space capabilities. It was as a result of that Presidential policy statement that we, in NASA, decided to ask the National Academy of Public Administration to undertake the study that has just been reported by Mr. Klutznick and his group. I might add at this point, Mr. Chairman, that we are indebted to Mr. Klutznick and to the very fine Panel that he assembled. The report is comprehensive; I think it is a very wise distillation of advice and counsel that that panel received from its membership, and it will be extremely useful to us.

It is clear, I believe, that after years of building on the technology base that we established, that we now have the opportunity to fully exploit the commercial opportunity. They pointed out many new ways and we will take advantage of that.

Commercialization is not new to NASA. As we all know, we have had a number of very impressive successes in commercializing space technology. The most important, of course, is the commercial satellite communications industry which is now one of the fastest growing industries in the world and which has very impressively joined us with the rest of the world in a way that could not have been possible 25 years ago.

We also recognize that there is a problem in making the nonaerospace industry, the nonaerospace segment, aware of the opportunities, both in the use of the space shuttle and the other opportunities that exist in the exploitation of the technology we have developed. We are going to try to enhance and improve our ability to disseminate information to the nonaerospace sector, as well as to make them more aware from time to time of the opportunities that are available through the shuttle.

We have, a system in place called the joint endeavor agreement which provides for a mechanism for a company to join with us. It reduces the costs of the experimental phase of any commercialization idea, and it facilitates their access to NASA technology. We are trying constantly to improve that mechanism.

If I may, Mr. Chairman, let me address one major issue which now faces the agency, which has been discussed by the Panel, and that is the commercialization of expendable launch vehicles. There have been various proposals put to us to operate the Delta, the Atlas-Centaur, and the Titan vehicles on a commercial basis, as well as the potential to introduce new expendable launch vehicles. We have reviewed the issue within NASA and we are still reviewing it. We are participating in a study of the senior interagency group (space). These reviews and studies will be completed later this month. At that time, we will have some decisions which will encompass the question of national security considerations and the issues associated with the use of the national launch facilities as well as the existing assets that exist in those programs.

I cannot at this point predict the outcome of that study, nor the policy which we will recommend. But, the activity is ongoing and I am confident that we will have a good policy very shortly that will enable our commercial friends to count on a stable situation, if, and when, they desire to enter into agreements with us to commercialize those launch vehicles.

Those are my views very briefly, Mr. Chairman. I will be pleased to answer questions.

[The prepared statement of Mr. Beggs follows:]

Statement of

James M. Beggs
Administrator

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

before the

Subcommittee on Space Science and Applications
Committee on Science and Technology
House of Representatives

Mr. Chairman and Members of the Subcommittee:

Mr. Chairman, it is a special pleasure for me to appear before this Subcommittee to participate in this series of Hearings on commercial activities in space. These Hearings represent a significant milestone in this Nation's space program. They are noteworthy in that the question being addressed today is no longer whether space has commercial promise but rather how best to proceed to maximize that promise for national economic well-being. In addition, they are timely because of the substantial interest expressed in commercialization by a number of industries. I have felt for some time that NASA should increase its attention to encouraging private sector investment and operations in space with the same quality of cooperation we, and our predecessor organization, the National Advisory Committee for Aeronautics, have achieved with the aeronautical interests in this country.

Shortly after the release of the President's July 4, 1982, National Space Policy Statement, which, in part, calls for the encouragement of domestic commercial exploitation of space capabilities, I asked the National Academy of Public Administration to undertake a study and make recommendations as to how best to engage the creative skills and entrepreneural initiative of the Nation's private sector in the commercialization of space. At the same time, I asked the Academy to examine the proper role of NASA in this arena.

Before giving you my observations on the Academy report, I would like to first express my deep appreciation to the Academy and in particular to Mr. Klutznick and other members of the Academy Panel who undertook this challenging task and did it so well.

The guidelines and recommendations formulated by the Panel were requested by NASA to help us deal effectively and properly with the various initiatives preented to us by industry. During the course of the study, the panel had a number of meetings with NASA management and with representatives from the industry who have expressed an interest in the commercial possibilities of space activities. I have discussed the observations and recommendations reached during the study with the panel members during the course of the study. I also expect the guidelines will be helpful to business firms contemplating a space endeavor.

Mr. Chairman, a clear message from the Academy report is that the United States, after years of building a technology base second to none, should not fail to examine fully the potential for commercial enterprise in space. A second message is the need for government/industry cooperation to make this happen. I fully agree with these views.

The Panel recognizes NASA's statutory role in research and development and the importance of NASA R&D to many commercial endeavors in space. The question we must ask ourselves is how we can most effectively continue this role and develop the right environment to support commercial potentials.

Mr. Chairman, the Panel has pointed out the many space endeavors by their very nature are high risk, expensive and long lead time activities. Stability, consistency, and continuity in policies are beneficial to business decisions. As a former member of that business community I am keenly aware of the significance of stability in policy. From my present position in the government I am equally aware of the difficulty in assuring that long-lead stability. In our relationships with industry and in formulating our policies we must seek ways to provide reasonable assurances and to be prepared to participate in a positive way in those areas impacting commercialization where other organizations are involved.

Commercialization is not new to NASA. The satellite communications industry grew out of early work by NASA. The spinning upper stages used in the Shuttle were developed under a joint agreement between NASA and McDonnell Douglas Corporation. Our experience has clearly been limited, however. Today the items we have been discussing represent quite a menu of opportunities in many different types of initiatives. We have started to develop criteria by which to evaluate these new ideas, to develop a proper government response to proposals, and to examine management and organizational approaches to assuring that the responsibilities of the government are properly carried out.

We also recognize the general unfamiliarity of the non-aerospace industry with space technology and space environment, and the importance of NASA facilities and associated hardware to the utilization of the space environment. We have taken an initial step through the Joint Endeavor Agreement approach to reduce the cost of using the Space Shuttle encouraging "path breaking" uses of space for commercial product research and experimentation purposes. We will look at our wind tunnel policies to determine what we can adapt from these policies regarding the use of other NASA facilities and hardware so as to facilitate and enhance the value of these facilities for U.S. industrial research activities.

NASA has made a start, as noted by the Panel, with Joint Endeavor Agreements and other cooperative arrangements to establish a two-way street with industry to identify potential opportunities, to expose our people to industry interests and requirements, and to provide appropriate support to commercial ventures. We agree with the importance of developing this relationship with industry and will seek ways to enhance the process.

We must, however, proceed with caution as we enter into this relatively new arena. Although I have indicated, I wholeheartedly believe that the time has come to encourage expansion of commercial involvement in space activities, it is imperative that we develop sound guidelines to define the Government's role in this process. We cannot ignore the fact that the American taxpayer has invested many billions of dollars in the knowledge and capability represented by today's space program. Nor can we proceed in ways which jeopardize the commitments and obligations that the government has in space programs -- commitments that derive from the long legislative history within which NASA operates. We must also deal with these issues in a balanced manner which assures adequate opportunity for all reasonable approaches by the private sector providing those approaches comply with a sound and logical set of guidelines. We are, in taking these steps, establishing precedents which could profoundly affect the civil space program in years to come. We must face the challenge in a way which will assure that the best use is made of the opportunity which it represents.

Finally, let me address a major issue now facing the Agency - the commercialization of expendable launch vehicles. Various proposals have been made to operate the Delta, Atlas-Centaur, and Titan vehicles on a commercial basis as well as to introduce new ELVs. We have reviewed this issue within NASA and have participated in the Senior Interagency Group (Space) study. These reviews will be concluded later this month. Many issues must be considered in the decision to commercialize ELVs, including: national security considerations, and issues associated with the use of national launch facilities. While I cannot, at this point, state what the outcome of these studies will be with respect to ELV commercialization, I see no reason, from a national policy standpoint, why such an activity cannot go forward.

Mr. Chairman, these are my views regarding the Academy study and our intentions regarding the implementation of its recommendations. I will be pleased to respond to your questions.

Mr. VOLKMER. Thank you very much, Mr. Beggs.

Mr. Lujan.

Mr. LUJAN. Thank you, Mr. Chairman. Welcome, Mr. Beggs.

Yesterday we were over at Lewis Research Center, and one of the things I was impressed with was the interaction between the private companies and the work of NASA in the aeronautics field, where they used those facilities to improve the airplanes. I would assume, as the space activities of NASA mature more, that that same kind of format will be followed in space activities; is that correct?

Mr. BEGGS. That is our intent, Mr. Lujan. We are seeking ways to get the industry involved with us in a more detailed way during the research and development phase. We have several proposals currently working. One is to involve the industry in the next phase of communication satellite technology at an early phase, with a joint program of exploiting the new frequency band made available. That is one way, I believe, of moving our technology more quickly from the research phase to a development and commercialization phase. We don't do that as well as we should in this country; as a consequence, we have found in the last 10 or 15 years that much of the technology is flowing abroad because they—particularly the Japanese, but also the Europeans—have learned how to take our technology and move it more quickly into the marketplace than we can. That is a shock to our system, therefore, we have got to start reexamining very carefully the various mechanisms by which we move technology from research to the marketplace. One way certainly is our joint programs, where they get the technology early, they get experience on it with us at the time, and then they can take it immediately to the marketplace.

The second way is, of course, to use the facilities that we have. The shuttle is the most impressive of those facilities and the most important. We want to encourage people to use the shuttle for commercial activities in many, many ways. We are trying to develop a system where we can fly payloads quickly and in a way that does not require the expenditure of large sums of money and effort to prepare for the flights. We are seeking to make standard the pallets that are currently available and which, incidentally, have been supplied to us by the European Space Agency. They are, in turn, seeking to use the same technique for their industry. But what we would like to do is make available to our industry the opportunity to fly on the pallets with an inexpensive payload which they can fly in a short time phase, because that is important, too, that they not be required to wait a couple of years when they have an idea. If they come up with an idea, then they could put it on a pallet, fly it, see whether it works; if it doesn't work, bring it back to tailor it to the lessons learned and then fly it again. So that is a second way that we can assist materially. Because what we are going to find in commercialization is that, as we exploit the capabilities of the shuttle, we will discover commercialization opportunities that we don't see now. That is the history of new projects such as the shuttle. You don't necessarily see clearly what it is that you're going to be able to exploit commercially at the beginning. So we want to make it easier for them to fly them, and we are working that very hard.

The third way, of course, is to make available our technology in a more complete way. Mr. Klutznick touched on this in his testimony when he said many people in the nonaerospace part of our industrial community just do not know the opportunities that are available. In fact, they're incredulous. Are there opportunities to exploit space that could result in large profitable commercialization? The answer is, "of course." We just haven't made them aware of the many things we are doing.

We are seeking to bring the nonaerospace industry into our program. We are doing that in several different ways. One is by quarterly symposia at each of the centers—that is, we rotate the symposia among the field centers. Each center hosts one of these on an average of once every 2 years or so. We invite a broad spectrum of all nonaerospace American industries to those symposia. The aerospace people, of course, are invited, but we particularly invite the nonaerospace people to those symposia. We expose them to what is going on in the centers, and they are starting to take advantage of it.

The Lewis Reserch Center, for example, which you mentioned, is probably one of the world's most impressive centers for the study of lubrication and bearings, which goes under the kind of arcane name of tribology. Bearings and lubricants are important to any industry which is involved with rotating machinery, so that activity can be of immense benefit once they learn it is there. A number of nonaerospace companies have learned it is there and are drawing on the technology that is available.

Mr. LUJAN. We saw that bearing work that they were doing.

Mr. BEGGS. It is very impressive work. One of the things you don't think about in that activity is that they contributed to the development of the artificial hip in that laboratory, which was a bearing problem that you don't think of but that is exactly what it is.

Mr. LUJAN. We were pleased with what we saw, particularly when we were coming home. We cut our visit short because of tornado warnings, and as we were bouncing up and down in the skies we were very pleased that NASA was doing all that research work and helping make airplanes a little safer.

One of the subjects that came up that caught my parochial interest, I might say, was in the area of space power systems. They were not able to answer some questions perhaps that you might be able to. They said Los Alamos was very involved in the space reactor work, as is Sandia, both of those laboratories being at home.

Can you give us any kind of insight, perhaps progress, or is that primarily military——

Mr. BEGGS. No, sir. We have entered into an agreement with the Department of Energy to take a look at much larger power supplies for space. As we look at the potential for space stations and large space platforms, we need available to us power of much higher capacity than anything we have today. The logical way to go there is by exploiting the nuclear power side, looking at power sources that could go as high as 500 to 1,000 kilowatts in size, because that is the kind of power you need when you start looking at the more advanced concepts of operations in space stations, the more advanced concepts of communications, direct broadcast, and the other applications that we see.

Mr. LUJAN. You are talking about the kind of power that would be needed to manufacture something in space——

Mr. BEGGS. Yes, manufacturing, processing, the whole gamut of starting with a manufacturing activity, which might require a sizable quantity of power, much more than you can get from solar panels.

Mr. LUJAN. Do we know the size of reactors the Soviets are using, that they have in space?

Mr. BEGGS. I believe we do, Mr. Lujan, but I am not your best witness on that. The kind of thing that came back through the atmosphere I don't believe is of the size we are talking here, but it is of substantial size.

Mr. LUJAN. One of the areas—speaking of nuclear research and cooperation—where the Department of Energy has been very successful and very cooperative is with university-type medical schools, where they operate hospitals and those sorts of things, cancer research with positive ions and those sorts of things.

Does NASA have some kind of cooperative work going on with university medical schools?

Mr. BEGGS. Yes, sir, of long standing.

Mr. LUJAN. I'm talking about medical research in space, like electrophoresis experiments.

Mr. BEGGS. We have long standing relationships with Johns Hopkins, with Stanford, with Washington University, St. Louis——

Mr. LUJAN. We have an excellent medical school in New Mexico, incidentally. [Laughter.]

Mr. BEGGS. I am pleased you reminded me, sir.

Incidentally, we are currently doing some very impressive research work with the Johns Hopkins, in which NASA puts up very small amounts of seed money, if you will, to develop a technique for programable, implantable dispensers of certain types of drugs, where the drugs can be localized to the specific area of pain or trouble. It looks very promising for the treatment of diseases like diabetes, possibly even for the treatment of such diseases as Parkinson's. That work grew out of space age technology, the development of very small devices that can dispense a very minute but measurable quantity of drug on a programed basis through the use of very small computers, which also are a byproduct of the space program.

Mr. LUJAN. Do you see the space environment having some effect on this, something down the line that appears to require that? I am just asking that question in terms of maybe somebody——

Mr. BEGGS. I don't know. There has been some speculation that a weightless environment might have some possible curative powers in certain types of diseases, but I have not seen any serious proposals of that type.

The best thing we have got going in the medical field is, of course, the electrophoresis idea, which continues to look extremely promising and which we will fly again on STS-8. We will continue to fly it until we finish with the experiments, to the production of clinical-size pharmaceuticals, where they can test them. At that point, we hope it will go commercial. If it does, we're looking to maybe the 1985, 1986 time period for that commercialization, and we hope it will pay its way by then.

Mr. LUJAN. I was asking that question more out of curiosity, as to what person with a particular type of illness might be the first medical payload, so to speak, on the shuttle.

Mr. BEGGS. That I don't know. There is some speculation, and I think some of our people could speculate with you on that.

Mr. LUJAN. It would be interesting.

Thank you, Mr. Chairman.

Mr. VOLKMER. The gentleman from Virginia.

Mr. BATEMAN. No questions.

Mr. VOLKMER. Mr. Beggs, in the report by the National Academy of Public Administration Panel, they suggest an office within the organizational structure, as Mr. Klutznick testified, near the top. How do you view that recommendation?

Mr. BEGGS. I generally agree with it. I am turning over in my mind now just the appropriate place for that to be located. We have a number of offices which, as you know, report directly to me in the executive side of NASA. Whether it should be given as a part of one of those assignments or whether it should be a separate office is what I am currently examining. But, we need to establish a single focal point where businessmen and entrepreneurs who have an idea can come and pursue it without having to work through the chain of the organization.

I have heard the same complaints that he heard. Sometimes it is difficult to get answers. So, we have got to give them quick access and an opportunity to get an answer when they need it, because once they start to invest money, time is expensive for them. We will be addressing that issue.

Mr. VOLKMER. Do you also agree that the person should be a person familiar with the marketplace, with business decisionmaking and marketplace experience?

Mr. BEGGS. Yes. Those people are hard to find in the Government structure, because they are hard to attract from industry, unless you can find someone who has spent his life in the industry, nearing the period of retirement, has done his thing, and wants to come in as a capstone to his career. But getting a young man with a good deal of tread left, which are the kind of individuals we like to get into NASA, is difficult.

Mr. VOLKMER. Do you have a time frame in which you plan to set up this office or appoint this person?

Mr. BEGGS. The SIG—space—study will bear on this to some degree, because they are going to make some recommendations as to lead agency for the commercialization activity in general. They are also going to make some recommendations as to how the coordination will take place between the large number of Federal agencies that are going to be involved in this venture. I would prefer to wait for that, to see what effect that has on the organizational decision. But, that decision should come by the end of May or early June, so we should be in a position to move on an organizational setup by June or July.

Mr. VOLKMER. That's fine. We do recognize, as you pointed out in both your statement and your oral presentation, that it is not a question any more of should we commercialize; it is a question of how we do it.

Mr. BEGGS. Yes, sir.

Mr. VOLKMER. In that, how do we involve nonaerospace companies in commercialization?

Mr. BEGGS. I think first we have got to make them aware of what is there. We haven't done a very good job of that, unfortunately. We are, I think, starting to get the kind of activity going as was mentioned here by either Mr. Klutznick or Mr. Mossinghoff. At the time of the next shuttle launch we were going to hold a symposium in Cocoa Beach for nonaerospace businessmen. We intend to hold conferences of this type on a frequent basis, to expose them to what we are doing. We point out certain technologies which we are developing and let them make their own decisions as to whether there are commercialization opportunities there.

We are not very good at that. You can see certain things very clearly: things like satellite communications and remote sensing, remote observations and so forth are naturals. But, the kind of commercialization that, I think, will take place drawing on our technologies is something that an entrepreneur can see more clearly than we bureaucrats who tend to focus more on the details of where the technology is leading, rather than where it might be apply in a commercial way. So, that is the first step.

The second step I think is to make available the technology on a more readily available basis. I would encourage the Congress to continue to look at patent policy, because I think patent policy bears a direct relationship into how fast these ideas are exploited.

No one is going to spend money in reducing a Government patent to practice if, after he does that, it becomes available to everybody else. I think that has got to be clarified in a way that makes it clear and gives some protection to the entrepreneur. If he spends money on developing something and reducing it to practice, even though it is a Government patent, he should have rights to that for a period of time.

As was suggested earlier, I think there is potential in giving incentives for the higher risk development of technology either through the tax laws or some other way that might make it more attractive. The best thing you can do in my view—and this is my personal view that I have held for a long time—is to do away with the corporate income tax.

Mr. VOLKMER. We don't want to go into that at this time, correct? [Laughter.]

Also, I would like for you to comment as to whether or not in the commercialization push—let's put it that way—or the idea to commercialize whatever we're going to commercialize, besides the expendable launch vehicles and possibly other things, do you see the need for congressional action for legislation at all?

Mr. BEGGS. No, sir, I do not. I think we have ample authority under the 1958 Space Act, as amended, to move out on those opportunities. A decision will have to be made as to who regulates this or who does the business of assuring that someone who wants to launch an expendable can get reasonably quick approval and doesn't have to wait a long time for various clearances to take place. Again, that is something the SIG—space—group is going to recommend. I hope and trust it will not be NASA, because we don't want to be in the regulatory business.

But, there may be a need to have the Congress either acquiesce or give authority in that area because there are a number of different statutes involved in that thing, as well as international commitments we have in the launching of satellites into space. But, we need nothing in the Space Act to give us full authority to move out and commercialize those expendables.

Mr. VOLKMER. What about the disposition of Federal property?

Mr. BEGGS. We have authority to dispose of it. Again, the question is, "How we dispose of it?" That comes in several different flavors. The launch facilities themselves are on Government land and they are owned by the Air Force. In fact, our launch facilities are on Air Force land at Cape Canaveral. That base is, of course, involved heavily in the national security area, so you can't dispose of the facilities on that land. So, in that case, we are going to have to come up with an appropriate lease policy for both the NASA facilities and the Air Force facilities.

I think, again, that will be studied and——

Mr. VOLKMER. Could I interrupt just a minute?

Mr. BEGGS. Yes, sir.

Mr. VOLKMER. On the launching, from what you just said, it appears that you are going forward with the possibility of commercializing the launching area itself——

Mr. BEGGS. Yes, sir.

Mr. VOLKMER. In other words, private industry taking care of launching their own expendable launch vehicles.

Mr. BEGGS. That is correct.

Mr. VOLKMER. So the idea that the Government continue in that because of the safety regulations, international complications, et cetera, you feel that all these could be overcome and without legislation.

Mr. BEGGS. I don't know about all of the issues of the whole business of the international involvement, whether that is going to require some action on the part of the Congress or not. I am really not your best witness on that. The Department of State is.

But, with respect to the launch facility itself, my feeling is that eventually we will be able to turn that over completely to the private sector. The one thing that I don't think would be possible to turn over completely is range safety. I think the Air Force would have to run that forever, just as they do for us in all of our launches. They should be able to set a policy for payment, though, that is reasonable.

The agency's view for a long time is that those kinds of facilities should be costed on the same basis that we lease and rent wind tunnel time, simulator time, and time on other equipment, That cost should be on an additive basis rather than on a full-cost basis. I do not believe it is reasonable to have someone come in there and pay for the cost of all of the base facilities, which are there for all of the reasons of national security and other reasons that they are required.

Mr. VOLKMER. On the expendable launch vehicles themselves, the various ones we are thinking of commercializing. What is the Federal value, would you say, in that, other than the technology? What Federal properties do we have?

Mr. BEGGS. The main part of it is inventories of pieces and parts of the vehicles themselves, as well as some vehicles which are in various stages of completion. On that, my view is they ought to be sold at whatever the Government cost is.

Mr. VOLKMER. What about tooling or manufacturing——

Mr. BEGGS. On tooling and test equipment, I think, Mr. Klutznick suggested market value. I think that is the best you can come up with on those things. Most of the tooling has been in existence for many, many years. I don't know what its value is to the Government. If we had a depreciation policy in the Government, it would have long since been depreciated to residual value. So its value to the Government is only what the market might bring for it.

Mr. VOLKMER. And you would probably only have those people bidding on it that are presently in the manufacturing of those launch vehicles.

Mr. BEGGS. I don't know. There is some interesting entrepreneurial activity taking place in that field right now. There are some folks who have gone to the venture capital market and seem to be able to raise some money to get in. I think the heart of the issue is the question of the inventories of vehicles because those have real value. They can go out and sell those. We will have to be very careful that we develop a policy where, if there is only a single bidder, that we get a price for those that is fair both to the company or organization that buys them and to the Government.

Mr. VOLKMER. Do you see a conflict between commercializing the ELVs? We look at the Ariane and see competition with that and the shuttle, and now in the future we will have competition within this country among expendable launch vehicles.

What impact do you see this having on shuttle operations?

Mr. BEGGS. In the short term, there should be little or no impact. For the next 5 years,we are going to be primarily fighting a case in the marketplace of being limited by our flight rate rather than by the market. After 5 years, it is conceivable that we will have a competitive situation develop as between shuttle and the expendables. And, if we do, then it will be a question of who can supply the most effective service at the best price in the marketplace.

In my view, the shuttle has many advantages over the expendables. We would not have gone ahead with the program had we not believed that. I believe in the long run the shuttle will have a significant market advantage. Nevertheless, I do think there is probably room in the long term for an expendable. I think that if someone takes on the expendable and he works it hard in the marketplace, he will always have a market. But I do think the shuttle will capture the lion's share of the market in the long term.

Mr. VOLKMER. On the joint endeavor agreement, as far as I understand it, right now we only have the one between NASA and McDonnell Douglas and——

Mr. BEGGS. No, we have two now. We signed another one the other day for the production of crystals in space. That has been an area that has been of intense interest to a lot of people, to make a perfect crystal lattice. We have a company that now is interested in doing that and we have signed an agreement with them. We have several other agreements in the negotiating stage but have not reached the point of signature as yet. Again, my view on this is that these things tend to develop as you learn, as we start to fly more frequently and get experimenters up there.

As you know, Mr. Chairman, we will be flying spacelab for the first time in September of this year. As we carry experiments up there in space lab and start to learn about the potential, I think we will see a lot more commercialization proposals before us.

After all, you know, the electrophoresis idea grew out of the experiments we did in skylab. It was only after they had gotten up there in skylab and started to experiment in that area that people started to get interested in electrophoresis in space. As I said earlier, we have got to make it easy for individuals and companies to get aboard the shuttle, to make it simple for them to fly low-cost experiment payloads in space so that they can learn in the actual environment. The ideas that come out of the program will come out as a consequence of having learned something we didn't know before.

Mr. VOLKMER. One other question in regard to the shuttle.

It appears to me—and correct me if I'm wrong—that we are still in the R&D stage as far as not only operations of the shuttle but what experiments, et cetera, can be utilized by the shuttle.

Mr. BEGGS. We are still learning, so in that sense we are in the R&D phase. We are operational, I believe, in the sense that we can now carry commercial payloads up on a reasonably firm schedule basis. We agonized this past three months with the problem we ran into on the three main shuttle engines, but having gone through that, I think we have now learned how we can handle that problem.

We're still a little short of spares and a little short of other hardware in the program, but we are starting to catch up. The encouraging part of it is that the folks down at Kennedy, who have to turn this vehicle around, put the stack together and get it ready for launch, are doing much, much better as time goes on. We feel confident that we are going to launch again in June. That will be our quickest turnaround of a vehicle since we started this program.

We feel confident that we can launch again in August, and again in September. So you can see from those schedules that we are starting to shorten the time spans between the flights, and that is because we are learning how to put them together, to bring them back, to refurbish and stack them again.

Mr. **Volkmer**. One last question and then I will recognize the gentleman from Florida.

As we look forward to the possibility of a space station—and I know the studies are going on and we haven't got to a definitive answer yet as to whether or not we proceed with whatever it is—but assuming that we do, do you not believe we can, as we get into the development of that, also consider the commercialization aspects of the usage of it?

Mr. **Beggs**. We already have interest in that area, Mr. Chairman. We have a group down in the Houston area that is studying on their own the potential commercial activities in a space station. They are looking at various alternatives as to how they could commercialize that activity, and we welcome that. We have integrated them into our study in the sense of giving them the results of what we are anticipating a space station would look like as we go through our studies. They, in turn, are telling us how they feel about the commercial activities.

We hope that, assuming we move out with a space station some time in the next year or two, that we will have commercial participation from the beginning, that they will join with us and help us in the development of that station in such a way so that when the space station goes into operation there will be a commercial adjunct there, or a commercial part of it.

Mr. **Volkmer**. Thank you.

I now recognize the gentleman from Florida.

Mr. **Nelson**. Thank you, Mr. Chairman.

Parenthetically, will you send up TDRSS in the August shuttle flight and, if not, what will you put on it?

Mr. **Beggs**. We haven't made a decision. We are still hoping. I have got to say I am somewhat pessimistic right now on the August TDRSS flight because it does appear we do have a problem in the IUS that might take longer to correct. If we don't fly that, we are looking at several existing payloads that we have available. There is a possibility of putting some commercial satellites on that flight, which are available and scheduled to fly in about that same time period.

We are also looking at things that we have in the development cycle, which are basically research payloads, which we could put aboard at that same time. There are a number of candidates, but I wouldn't like to commit myself as to which ones, Mr. Nelson. I think there is a sufficient number of potential payloads that we can plan on flying that mission. It is important that we fly the mission, for the somewhat complex reason that we are trying to build up flight rate. It is important that we continue to build that flight rate, because next year, as we know, we are going to be trying to fly nine or ten times so that this builds on itself.

Mr. **Nelson**. I have missed, Mr. Chairman, most of the testimony here, but I would assume, Mr. Beggs, that you have made a statement that you were basically in favor of commercialization of expendables?

Mr. BEGGS. Yes, sir.

Mr. NELSON. Then my question would be: There are some quarters—and I don't attribute this to you and your organization—but there are some quarters that would like to see the commercialization of expendables, thinking that that would give them the alternative to the fifth orbiter. Can you comment on that?

Mr. BEGGS. I think it is a little more complex than that. The question that has been addressed by a number of folks is the number of shuttle flights that you should build up to in a reasonable way, and I guess looking at the question of the number of flights that we can reasonably schedule over the next 5 or 6 or 7 years. The reason it is complex is that it relates to the size of the marketplace, the number of payloads one wants to fly on various and sundry different vehicles, the status of Ariane and a lot of other things.

But yes, there is a body of opinion which says we should keep the expendables around forever, using them to handle the simpler payloads, the ones that don't require the unique capabilities of shuttle and reserve the shuttle for the more complex and larger payloads. I personally don't agree with that. I think that is a bad policy because building up the flight rate on shuttle is extraordinarily important from a cost point of view.

The most sensitive thing the shuttle has, or the thing that the shuttle is the most sensitive to, from a cost standpoint, is flight rate, because you have got an army of people at the Kennedy Space Center who are there all the time, have to be there all the time, even if you fly only once a year. So the more times you can fly, the more you can spread that cost over flights.

In addition to that, the production cost of expendable pieces of shuttle, the external tank, pieces of the solid rocket booster that we expend each time we fly, becomes cheaper with higher flight rates simply because you get the advantages of serial production, where you can reduce the costs of manufacturing. So, the flight rate is extremely important from a cost point of view, and we feel strongly that we ought to proceed and continue to build the flight rate up until we hit that 24 a year, which we have set as an interim target. Assuming the market continues to develop before we hit that 24-a-year flight rate, we would come back to the Congress and ask for the necessary funds to tool up, to go on up to a 30 or 40 flight rate.

Mr. NELSON. Do you think 24 a year can be serviced with only four orbiters?

Mr. BEGGS. Yes, I do. I think, as the study of the Academy the other day pointed out, they would argue that it is marginal in some respects. We have studied it, too, and we think there are adequate margins with four. Obviously, the most important consideration is the loss of one, either through an accident or where we would take it out of service for repair. It is conceivable we would want to take one or more of these orbiters out from time to time to modify them, to do other things, and to do things better. So then we would be down to three, and three is definitely below the margin. You can fly three 24 times a year. I think we will demonstrate we can fly each one 8 times a year, but you can't do that on a continuous basis.

Mr. NELSON. That's correct. Therefore——

Mr. BEGGS. The loss of one would be a serious problem, and that is the reason we did fall back to the recommendation we made to the subcommittee this year, that we fund structural spares so that we can repair an orbiter, if that is necessary or assemble one, assuming we have a need to assemble it. As the President said early this year, in addition to that, should the more optimistic predictions of the market come true, then we would assemble a fifth one. But, four would be adequate to fly 24 a year on a continuing basis, absent an accident or a loss of an orbiter, for whatever reason.

Mr. NELSON. Including modification.

Mr. BEGGS. Yes, sir.

Mr. NELSON. Now, how about 30 or 40 a year?

Mr. BEGGS. No, you couldn't fly 30 a year with the four. You would have to have five. If you want to go to 40, the Academy study said we would need six. As a matter of fact, they would argue that six is marginal for 40 a year. I think we would allege that six is adequate, within the margin for 40 a year.

We will be learning over the next few years. We do have time, I believe, to make that decision over the coming year, year and a half, as to whether we will get a fifth, and we do have time, I think, should we order a fifth, to have some more time to consider whether we want to buy the sixth. In the meantime, we will be getting a lot of flight experience. We will be up to flight 10 this year and we will be up to flight 20 next year, so as we get down the experience curve, we're going to know a lot better how well we can operate these machines and how quickly we can turn them around.

Mr. NELSON. You made another statement that I thought was most intriguing and also most encouraging. You said words to the effect, a few minutes ago, of being able to start on the space station in the next year or two.

Would you like to expand on that?

Mr. BEGGS. No, I said "should" we start on a space station within the next year or two, we would have——

Mr. NELSON. Maybe that was my optimism.

Mr. BEGGS. I believe we would have strong commercial participation. I think we will have commercialization in that activity. I also think we could anticipate a good deal of foreign participation in the program because the international community is intensely interested in it as well.

Mr. NELSON. Let's assume that the "shoulds" and the "ifs" turn to "noes", and that we didn't have a commitment for a space station nor for a fifth orbiter. What is the future of projects like electrophoresis if you have only got four orbiters? Can you guarantee them 5 years in the future that they are going to have space on the shuttle so that they can go out and retrieve their manufacturing?

Mr. BEGGS. We would have to go to a platform approach. The McDonnell Douglas people are on record on this one as preferring a space station environment for the future of the electrophoresis. But should we not have a space station, then we would have to develop platforms, and there are several platform ideas around. Indeed, there are some people around the world which are developing platforms. Incidentally, platforms will be developed even if we have a space station, because you will need free-flying platforms which will either fly with the station or fly independently over time.

There are other alternatives to going the space station route. The NASA view has been made clear, that we think the space station is the preferred alternative. But that remains to be fully staffed out for the President giving him the benefit of a study which encompasses more than the NASA view. I think he deserves that.

Mr. Nelson. And please share with him the information that the Soviets have had a space station up since the early seventies.

Mr. Beggs. They have had a lot of experience.

It is kind of interesting. I reread the history of our planning recently and went over the way in which NASA had early on planned this activity, because we have had our eye on a space station really for 25 years or longer. When you read the planning, it turns out that the way NASA had planned it initially was to put a space station up and then to follow it with a shuttle, the idea being we could start to learn about what we wanted to do in space and service it with expendables while we got the shuttle ready. Then, by the time the shuttle came on line, we would have a lot of commercial and other science and engineering work underway. For whatever reason, the Nixon administration decided to turn that around and bring the shuttle on first. I believe, in reading that history, it was stated at that time to do the shuttle first and then follow it with the exploitation of space by the use of a station.

The Soviets, on the other hand, have apparently gone with the original plan. They have gone with the space station first. I guess the third Minister, or one of their officials out of the embassy, announced last year that they were going to follow it with a shuttle. So they are following the original plan and we modified our plan. It is going to be kind of interesting to see who was right, assuming that we go forward and follow the shuttle with a station. Although as we all know, we have a great ability in this country to catch up on things like this, if we really want to. Our technology generally is superior and we will, I think, overtake the work that the Soviets have been doing in space stations very quickly if we decide to go forward.

Mr. Nelson. Let me just say that I am an unabashed fan of your agency——

Mr. Beggs. We appreciate that.

Mr. Nelson. I have seen what you all have been able to accomplish in the past. If we can ever get the commitment from the President of the United States to go with the space station, then we can really utilize that fantastic flying machine and we can just start to grow by leaps and bounds so that the Soviets won't be ahead of us.

Mr. Beggs. President Reagan has been very friendly to America's space program.

Mr. Nelson. And so has the Vice President.

Mr. Beggs. Yes, he has.

Mr. Nelson. As a matter of fact, I am going to be with the Vice President tonight and again I am going to thank him. In a couple of visits that he has had to the Kennedy Center, he has really pumped people up there.

Mr. BEGGS. During the last flight, he was in Houston as well, and that was a great morale builder.

Mr. NELSON. Let me ask you this, Mr. Beggs. What is NASA doing now to develop a market strategy for our shuttle fleet?

Mr. BEGGS. We are doing several things. First of all, we are trying to develop the basic things that we need to do in order to make it easy, in order to "facilitize" the customer to use the shuttle. In the early days, I say early days, it was just a year ago, 1½ years ago—we had to worry about safety and we had to worry about the unknowns in the use of the shuttle. We had imposed a fairly strict regimen on our customers which required a number of different reviews and which, quite frankly, unless a company or an individual is familiar with the aerospace business, was quite difficult for him. We have got to simplify that, and we have been considering how we set this thing up in such a way as to simplify the various procedures and hurdles that the customer has to go through in order to fly.

Second, we have been looking at the worldwide market with an eye to seeing whether we can improve our contacts with potential customers. It is not easy for a Government agency because we have restricted travel budgets and we have a difficult time in doing the kind of sales promotion work that one can do, if he is in the private sector. But we can do a certain amount of that. We want to draw on the available Government assets in the Department of Commerce and in the Department of State. Commerce has been trying to upgrade the commercial attaches and they can be of value to us. We are going to try to use them.

Third, the question is, "How do you expand the market?" That is a question of making known the service that we can provide. In that area, I am pleased to see quite a lot of entrepreneurial activity. A number of different companies, including some large ones like Hughes Aircraft, and some small ones, are considering setting up at Kennedy to provide a service of making it easy for someone who is not familiar with the aerospace industry or with the space program to integrate a payload, whatever the payload might be. That's important. If you put all those things together, I think we can come up with a good marketing strategy that will make it possible for us to make our service available and to make the commercial customer and any other customer, as far as that goes, whether it be a foreign government or a group of foreign entrepreneurs, to come in and have access to our service.

Mr. NELSON. Thank you, Mr. Chairman.

Mr. VOLKMER. The gentleman from Pennsylvania.

Mr. WALKER. Thank you, Mr. Chairman.

A few minutes ago Mr. Nelson asked you a question that I think needed an answer, and I am not certain I understand the answer. He was talking about the electrophoresis process and was asking whether or not the shuttle fleet as presently contemplated would be able to provide ongoing service 4 or 5 years down the pike to a platform that might be put in place to carry forth that process. There was a discussion of space stations and so on, but that sort of question is very important to the people who are looking to commercialized activities in outer space. They have to be assured that after making the investment the return on their investment is going to be serviced by the fleets they would need. In this case the shuttle is absolutely essential to the process.

Are we able to give such firms that kind of assurance right now, that if they would go to the expense of launching their own platform, that on a regular basis the shuttle would be able to fly by and milk their platform, to get the material back here for profit-making?

Mr. BEGGS. Yes. I just looked at the manifest out for the next 3 or 4 years. There are several questions that they ask. First of all, assuming they want to fly on a continuous basis on a platform, they want several things. One is that we will take up material to recharge the system from time to time, that we will take back the finished product, that we will occasionally bring the equipment back for refurbishing and redo, and that we will be able from time to time to do some maintenance on the platform.

In no case that I can see currently are we limited by the shuttle. We have no manifest as yet in the commercial side where we are limited by either weight or volume. The limitations are all in some other areas. So we can always add something. That's why I said earlier, we would like to develop a strategy where we provide on a short term and easy basis the opportunity for commercial folks to fly cheap payloads, cheap experiments, to test out an idea in space. If you ask McDonnell Douglas, they would be satisfied that we can do that job for them, at least for the foreseeable future.

Now, the question of what do you do when you get a downed orbiter and you have got all kinds of priority requirements, if you have a problem that requires the layup of some orbiters, yes, those are problems. I think we are going to have to think through very clearly how we would operate in an emergency situation and make sure that we did supply our customers.

Mr. WALKER. Or the other question——

Mr. BEGGS. Because they will be a very valuable customer, assuming they're in that phase.

Mr. NELSON. Would the gentleman yield?

Mr. WALKER. Just let me followup and then I will be glad to yield to the gentleman.

The other question that occurs to many of us is, what happens if national security considerations begin to take a major part of your flight manifests that you don't anticipate right now? I think that worries commercial entrepreneurs as well, that all of a sudden a scheduled flight to either recharge their facility or pickup supplies from their facility is bumped because of a national security flight that becomes a must. In such a case, the loss of their investment could be extremely substantial. And with a limited number of orbiters, that becomes a very key consideration for them.

Does your analysis include that kind of problem in terms of what commercial people are saying?

Mr. BEGGS. It includes the current DOD plans, which I might say are not going to use a very large percentage of the shuttle capacity. As we all know, national security does have a priority in the use of this system, and if national security implications, whatever they are, emergencies or what have you, would call for the use of larger amounts of the capacity, we would have a problem. That's clear.

On the other hand, the Department of Defense has agreed with us that we can use the defense flights to also service commercial customers. That is to say, they can be mixed. Assuming those defense flights were in the right inclination, the right orbit to service, we could service on one of those flights. Quite frankly, I am more concerned at the present time in trying to get the DOD to fly as much as it said it was going to fly, rather than it flying too much. But it could be a conflict in the far out future on that and we are going to have to work that problem with them to make sure that folks who are depending on shuttle services get shuttle services when they need them. If that requires the investment in another orbiter or two, then we're going to have to invest in another orbiter or two, and the current policy does not preclude that.

Mr. WALKER. Let me ask you a question that I asked earlier today. What would be your comments on an amendment to the Organic Act for your agency, to put some language in that would indicate a need for more commercial activities and would give you a specific assignment to be a participant in the commercialization of space?

Mr. BEGGS. Mr. Walker, I consider that I do have such an assignment under the current bill. As Gerry Mossinghoff said, the 1958 bill is a very far-sighted bill. It contains a lot of authority to disseminate and what have you.

Now, in the case of the Comsat, where we wanted to transfer a specific piece of technology to a single entity, we asked for a specific piece of legislation. But, so long as we have a number of different people who want to use the technology or want to use a specific product, we have no problem at all in transferring it to them. We have always tried to keep this subcommittee informed as to what we were doing in that regard, and we will continue to do that. But, I don't consider that I need any other authority to do that unless, as I say, it got down to a point where we would want to create a monopoly or a near monopoly in some area.

Mr. WALKER. It wouldn't be helpful at all to have some language that says that commercialization is a part of the role of the agency?

Mr. BEGGS. We would be willing to sit down with you to discuss the language. But right now, I don't feel any need for any additional language.

Mr. WALKER. Well, one of the situations that is developing, again as you talk to people who are trying to move aggressively into the commercial area, is the fact that they feel as though NASA sees its R&D role as being the superior role—and there is no doubt that that's what you are all about, and there is no doubt that in the Organic Act that is what you are really given.

I don't see, either, any impediment to your going into commercialization. The question is whether or not your agency feels as though it should aggressively pursue commercialization and whether or not that is a major part of your mandate. I guess the question I have is, if we were to expect you to move aggressively toward commercialization, shouldn't that be a part of the mandate of the agency?

Mr. BEGGS. We discussed earlier the question of setting up a better mechanism or a single point of contact. We will move out on that in the next few months to do just that, set up an organizational activity which gives a single point of contact and which will expedite any request for a commercial activity.

With respect to the language to do that, I feel I have ample authority to do that without any additional language. But, if you would like us to come talk to you a little bit more, we can discuss that in greater detail.

Mr. **Walker.** You mentioned a point here a minute ago that strikes me as being one crux of the problem. You mentioned the point that in trying to sell space aboard the shuttle, for example, you don't have adequate travel budgets. You have got to look at that. I think that is absolutely true, that one of the problems is that Government agencies have to operate like Government agencies. They don't operate like businesses. There is no particular advantage, in terms of your perception, to turn a profit; whereas the sales department of a major company becomes a crucial element and is given the kind of money it needs to do a job of selling. You come here and you are not likely to get the kind of money that you need to go out and do a sales job in the same way that a company would.

That's a concern for me. I think that, no matter how you are organized, you still are going to be a Government agency with some specific things to do as that agency. The question is whether or not you will ever become a commercial entity and would ever have the kind of support as a commercial entity. So I guess my question is whether or not such a reorganization is the question here. Should there be an aggressive pursuit of seeing to it that the people who can sell these ideas are given the opportunity to get the job done and get it sold? To make certain there is some access, for instance, to your shuttle technology; that there is some access to ELV's; there is some access to all of these things that they say they need in order to see a presence in space.

Mr. **Beggs.** Yes; it is a complex question. However, the Europeans do this with their government activities, I guess, in a much more facilitating way than we do. For the Ariane, for example, they set up quasi-government activity which masquerades as a commercial activity, even though it is wholly owned by the government. But it acts as though it is commercial and it operates as though it is commercial.

We don't tend to do it that way in this country. We tend to leave our exploitation to the private sector, and, frankly, I think that is the better way of doing it. But it does mean it imposes a special responsibility on my agency, to make sure that the technology does flow and that the products and services that we are trying to move into the commercial area do get into the private sector.

As I mentioned earlier in response to a question, I have to say that we're in trouble in this country and maybe we ought to reexamine all of our mechanisms, because we're finding that the Japanese and the Europeans in many cases can take our technology and move it to the marketplace faster than we can. That is of concern. I have done a lot of soul-searching on that as to how we can help that go through. But I am not sure, in thinking this through, that bringing in a commercial marketing activity is the right way to do it. I am not sure how you would set that up. I think what we have got to do is find some better ways of disseminating and moving this information to get the attention of the entrepreneurial community in this country at an earlier date, because we're good at this when we get around to doing it. The world looks at America as the foundation and beginning of all that. But we haven't done it very well in the last 10 or 20 years. I think it all started back in the mid-1960's, but that's another issue.

Mr. **WALKER**. The chairman has been more than generous with the time, but if I could just follow through with one more point, I think you come right around to my original point; that is, many of the people who are in the commercial field view NASA as having a role set apart from commercial activity, and while you may have the authority to do these things, you are viewed by the most aggressive people within the commercial establishment as being something other than a commercial entity. That probably is as it should be. I think you're absolutely right, that I'm not certain we ought to make you a marketing agency.

But we also, though, ought to make you the facilitator of marketing people. If there is a huge market developing out there if, in fact, we are on the verge of a commercial revolution in outer space, then we ought to at least make certain there is a friendly relationship between you and the people who are going to do the marketing. We ought to make certain that they see you as having a mandate to have that kind of a friendly relationship to their marketing practices. That is the reason why I suggested that perhaps one of the things we need to do is say, as a part of your organic act, that you do have as one of your prescribed duties the job of making certain that technology is commercialized and that we move aggressively toward getting the marketing people out selling outer space for profit in the future.

Mr. **BEGGS**. Yes, sir. We are very friendly.

Mr. **NELSON**. Will the gentleman yield?

Mr. **BEGGS**. We welcome the commercial folks who come in and talk to us.

Mr. **WALKER**. Thank you, Mr. Chairman. I appreciate you being generous with the time.

Mr. **NELSON**. Would the chairman indulge me by unanimous consent for 1 minute?

Mr. **VOLKMER**. 1 minute.

Mr. **NELSON**. I will say "amen" to Mr. Walker and a number of his comments. I half-way heard it as I was meeting outside the room, but I think I know what he is talking about and I think I know how it applies to the Stockman letter of last June and so forth—and you know what my feelings are there.

I just want to make this comment. I hope that NASA—and this indirectly affects the question of commercialization, which is the subject of this hearing—I really hope there is some serious negotiation between NASA and the Department of Interior at the present with regard to the proposed oil drilling right off the coast of Florida. Those proposed oil leases come within 12 miles of Cape Canaveral. It would have devastating effects upon your mission, upon the mission of the Department of Defense. I have not really taken this seriously until recently because I figured that the Department of the Interior might have its problems with environmentalists, but I sure didn't think it was going to have its problems with the Department of Defense, nor NASA. The fact is you just simply cannot allow solid rocket boosters parachuting into the Atlantic hitting oil derricks. Nor can the Department of Defense have the risk of whatever they fire out there bumping into and crashing down upon oil derricks.

So I have taken a very strong stand. If all is said and done and the July 26 date comes and the sale is going to be made, if you all can't sue—because one agency of the Government can't sue against another—then there is no other choice but that I or a combination of individuals, and maybe other Government entities, will have to get into it. I can't see in any way that you could fathom that that would occur.

Mr. BEGGS. Both, NASA and the Department of Defense are in very serious negotiations with the Department of the Interior on just that subject. We haven't reached a satisfactory conclusion to them, however, but we are still talking with each other.

Mr. NELSON. Well, use me in any way that you think I can help nudge the process. This affects far beyond the bounds of my district. I mean, your area that you have got to keep clear goes all the way up off of Charleston, S.C.

Thank you, Mr. Chairman.

Mr. VOLKMER. The gentleman from California.

Mr. BROWN. Mr. Chairman, I know you have an additional witness. I just wanted to very briefly raise an item or two.

I had the opportunity this weekend in California to speak to a number of people involved in space activities. One of the issues raised there which I was unfamiliar with was the problem apparently experienced with regard to the commercialization of launch services through a sea-launched expendable launch vehicle. While I do not want to pursue the particular case, I want to ask about the general situation as to whether or not there is an effective policy and administrative mechanism for clearing up difficulties of a small firm, for example, that was trying to get involved in this kind of activity.

Is it a situation that could be better described as a hodgepodge, in which you don't quite know who to go to, to get all the clearances and permits and whatnot that may be involved in doing something that hasn't been done before?

Mr. BEGGS. It is at the moment chaotic, Mr. Brown. There are between half-a-dozen and a dozen different Federal agencies which involve themselves in any kind of launch activity or activity involving space, from the Department of State, the Department of Defense, to the FCC, to the FAA, to NASA, and to a number of others.

As I mentioned, I think before you came in, we have an ongoing group working that problem to try to come up with a recommendation for a lead agency which would be responsible for getting a small company, for example, the answers that it needs and to expedite a permit or a license when they require it.

Mr. VOLKMER. If the gentleman from California will yield. We will be holding hearings specifically on this matter on the 18th of this month, with some of the people that have been involved in it.

Mr. BROWN. Good. I am very glad to hear that.

May I make one additional comment with regard to the general policy of commercialization. I have glanced rather briefly at the study which you initiated and I see nothing in the summary that I can take umbrage at. It looks like a good approach to the situation. Yet I still remain concerned that we underestimate the policy implications and complications of this.

I look back to my own involvement over the last 20 years with the nuclear power industry as an example. A very large and important commercial industry stemming out of federally-funded research, as the space program is, in which we still maintain a very large Federal involvement in advanced research, will require the development of regulatory activities of a fairly complex and comprehensive nature. I wonder if we are examining the future in space with an awareness of all the complexities of the Government/private industry coordination and other problems that are likely to arise.

Will we need a regulatory agency in space, or are we going to continue to have, let's say, the FCC regulating one thing, say orbital slot allocations or frequency allocations, and somebody else regulating something else? In other words—this gets to a point that I make frequently—has there been some effort to anticipate, forecast, and do some policy planning for the complexities of the future that we can almost guarantee are going to arise before we know it?

Mr. BEGGS. We are trying to come to grips with just that issue. It is a question of what policy is proper for the United States to assure that the space environment and the space activities are not overburdened with so many restrictions that the entrepreneur will fear to enter.

It is complex right now because you do have a very large number of different Government agencies which have their finger in it. But, it is our hope we can shred that out in such a way to provide a single point of contact. There will undoubtedly have to be some regulations because, as you know better than I, we have international obligations in this area and they will have to be observed. But I think that could be set up in such a way that it would ease the entry of companies into the exploitation of much of the space technology. But you are quite right, we have got to address the policy implications of that and insure that we don't overly complicate it in the near and far distant future. Investments in space tend to be quite large. You can't do anything. It's not a friendly environment and you can't do it on a shoestring. When you commit to do it, you are committing to spend a lot of money. So we owe it to the commercial folks who want to invest to make it as easy as possible and don't overcomplicate it, and when they commit their money, that they have reasonable assurance they can go forward and do what they want to do.

Mr. BROWN. Thank you.

That's all, Mr. Chairman.

Mr. VOLKMER. Mr. Beggs, before we go to our next witness, I would like to say I have reviewed the report from the National Academy of Public Administration, and one of the things they say right within the summary is for NASA to make a clear statement of commitment to commercialization as a policy of NASA—and I believe you have done that today.

There are other things in there that I think, as you have testified, will have to await the senior interagency group on space's recommendations later on this month or in June. For example, there is the question of institutionalizing a major commitment within NASA to provide a well-defined top level management focus. Those things we can anticipate, depending on what that group recommends, I assume.

Mr. **Beggs**. Yes, sir. I would like to say again it is an excellent report and I have gone through it in detail. I find nothing to quarrel with in the report. All of its recommendations I believe are sound and we will be seeking to implement those as we go along.

It does, of course, require the aforementioned coordination with other agencies and departments of the Government, and that is underway with the SIG [Space] study. As those results become available, we will try to implement those parts of the report as well.

Mr. **Volkmer**. In closing, the gentleman from Florida and the gentleman from Pennsylvania brought up some matters in regard to the shuttle and the maintenance. I have read the report from the academy and I think at a future time we should discuss those issues that are discussed in the report, as to the question of the number of shuttle flights per year.

Mr. **Beggs**. Right. Yes, sir.

Mr. **Volkmer**. Thank you very much for being here today. We appreciate your participation in the hearings.

At this time we would like to have Daniel J. Fink, Chairman of the NASA Advisory Council, come forward. Mr. Fink, your statement, too, will be made a part of the record and you may either review the statement in full or summarize, however you so desire.

I appreciate the long time you have been waiting, but we will proceed at this time.

STATEMENT OF DANIEL J. FINK, CHAIRMAN, NASA ADVISORY COUNSEL

Mr. **Fink**. Thank you very much, Mr. Chairman. It is a pleasure for me to appear before this distinguished subcommittee to comment on the commercialization of space and the role of the private and public sectors. The subject is important, timely, and one that I have been personally interested in for a number of years.

My comments today are based on my understanding of past commercialization efforts, both from my own participation and from observations of the successes, and some failures, of others. While I do currently chair the NASA Advisory Council, these views do not necessarily represent the Council, which has not specifically addressed this issue and, therefore, takes no position.

On the other hand, we do have presently underway two task forces, one dealing with future missions of NASA, and the other with shuttle utilization. Both may touch on some aspects of the subject at hand. When completed, this work will certainly be available to the committee.

The National Academy report is an excellent baseline on which to initiate these hearings. It recognizes a number of factors which I do believe bear repetition.

First, that we in this country have perhaps a unique opportunity to maintain our leadership in space if we can truly tap the additional contributions that can be made by the private sector.

Second, that many facilitating steps must occur to make this happen.

Third, that in the foreseeable future private space ventures will not be laissez faire activities; the Government will interact on many levels.

Finally, the report emphasizes the unique role the Government must continue to play in advancing the state-of-the-art and in carrying out the longer term and more ambitious endeavors which will be required if we are to continue our international space leadership.

In short, like other thoughtful treatments of the subject, it discusses a blend of free enterprise and public/private cooperation that is not the norm in our way of doing business. In the time available to me, I would like to make just a few additional and perhaps amplifying points.

To me, free enterprise implies both the element of choice on the part of the private sector and the expectation that they will take the initiative in trading risk for reward. I would call that private initiative, as it applies to space endeavors, commercialization pull. When we have it, success normally follows closely in its wake.

The first commercial proposition for a communications satellite appeared in 1961. No undue prodding by the Government was required. Rather, the Government responded admirably to that commercial suction. Contrast this will remote sensing, where commercialization push by some parts of the Government started, as I recall, in the midseventies. I believe such push can be counterproductive to the progress we all want to see made. It certainly has been frustrating to the Congress.

Some elements of the Government behave as though their statements on commercialization are now fact, expecting the private sector to rush in and fill the breech. This has yet to happen because the interested private parties see the Government as the principal customer for the product, but this customer makes no quantitative commitment to this fact. Perhaps we should recognize that, when the Government is the principal or sole customer for a product or service, commercialization may offer some private sector efficiencies, but it is not really the entrepreneurial engine that we all look to for expansion of our space endeavors. At times it may be little more than an alternative form of contracting or funding and should be recognized as such.

I would rather that we concentrate our attention on those areas more representative of free enterprise where there is commercialization pull; in other words, where the private sector is initiating activity and the Government is gearing to respond.

This is now happening in launch vehicles and launch services and I hope will be increasingly evident in materials processing in space as initial successes are publicized and understood. There seems to be little argument that such commercialization is a good thing and should be encouraged. But verbal encouragement and pats on the back are not enough. Positive statements and policies issued at high levels, while important, are not sufficient.

As a recent corporate strategic planner, I know that the best plan is worthless if it lacks an implementation program. Healthy industries have competing demands for their investment dollars. Those opportunities with unresolved uncertainties and risks that are seemingly not controllable will simply be sacrificed for those with a more certain return. It is not that industry will not take risks, but far better the business risk that intelligent application of their own effort and capital might ameliorate than the risk of a Government, no matter how well intended, changing its mind.

It is therefore vitally important that the policies now being developed to encourage commercialization be translated into actionable events by officials responsible for implementation. This is not a trivial statement because often these officials are many layers from the agency heads and are more used to the adversary contractual process than the cooperative efforts now demanded.

Perhaps if we were operating in an international vacuum this wouldn't be so important. But this subcommittee needs little reminder of the overseas competition that has now extended into the space arena, nor of the strength of Governments and industries working together.

It is not my intent to develop a complete list of uncertainties that will need resolution, but included should be questions of Government restraints on access to the market; controls on pricing, if any; and a much better understanding of the implications of national security overrides and their sensitivity to policy changes.

There may be need for restraints on the Government which proscribes them from future competition with the private entity and limits international agreements which create overseas competition. The costs of regulation must be understood and, most important, early negotiations are required on the costs of Government facilities and services needed by the private sector with some guarantee of their stability over time.

Other implementation requirements are included in the NAPA report, including rights in inventions, insurance, and so forth. If these issues are handled in a businesslike manner, I am very optimistic that there will be increasing private involvement in space activities, particularly where there is already commercialization pull, such as in the provision of launch services through expendable launch vehicles.

We must also recognize the implications this will have for the space transportation system and the manner in which the shuttle is used. The NAPA report recommends against commercial operation of the shuttle at this time because, in their view, it has not yet attained technical maturity.

There is another reason for not rushing into shuttle commercialization. If the commercial ELV's are successful, then by definition there will be some unloading of the shuttle manifest. Rather than being discouraged by this event, I would be encouraged by the impetus this should give to both military and civilian use of the shuttle in research and development. In my view, such use has been inhibited because any R&D planner looking ahead could see the shuttle fully utilized as a space truck with no U.S. alternative to shuttle launching.

He further faced the recognition that priority must be given to maintaining the military and commercial schedules with little room for far-reaching programs that might use the unique properties of the shuttle: its size, the use of man, and its servicing and retrieving capabilities. This, then, is another reason for not prematurely commercializing shuttle operations. It has too many other values to the nation.

In summary, Mr. Chairman, I believe the United States has a unique opportunity to extend its leadership in space technology, science, exploration, and applications through proper exploitation of Government responsibilities and private sector initiatives. Clearly, the public policies are moving in this direction. My principal caution is that we recognize the complexity of the path on which we are embarking; that policy statements, while required, are not sufficient for success, and that much attention must be paid by all parties, private and public, in implementing the policies if we are to succeed. The importance of this endeavor to our Nation is admirably expressed in the closing paragraph of the NAPA report foreward, which I quote:

> At a time when our Nation has suffered losses in areas of technological creativity where it was once the undisputed leader, the space program has provided a compensating stimulant, the tempo of which must not be lost. The prospect for business ventures in space technologies represents a major opportunity to demonstrate that within the free enterprise philosophy there is a great potential for cooperative endeavor between the public and private sector. Pursuit of this opportunity could become a model for joint public/private efforts in other areas.

Thank you.

Mr. **VOLKMER**. Thank you, Mr. Fink.

We will now go to questions. The gentleman from Florida, Mr. Nelson.

Mr. **NELSON**. Thank you, Mr. Chairman.

I want to make sure that I am comprehending what you are saying here. You say don't rush into commercialization of the shuttle. By that, you're not implying that we should not proceed with such future use of the shuttle for industrialization and commercialization?

Mr. **FINK**. No, no. I meant strictly operations. I think the use of the shuttle by commercial entities should be encouraged dramatically.

Mr. **NELSON**. For example, right now, you have heard in this hearing today about electrophoresis. They are doing the experiments and at a certain period of time in the future they're going to be ready to leave those components up there for their own manufacturing and particle separating.

Now, that is commercialization of the shuttle. Is that, in your definition, rushing into it or not?

Mr. **FINK**. No, no. I am all in favor of that kind of commercialization. I simply meant the operation. The providing of the launch services itself is the part I wouldn't rush into.

That's the same thing the NAPA report said. They said just hold off on trying to have the shuttle operated by the commercial entity.

Mr. **NELSON**. Oh, I see.

Mr. **FINK**. It's use, I thoroughly encourage.

Mr. NELSON. Fine. I understand. We're thinking the same way then.

Thank you.

Mr. VOLKMER. Does the other gentleman from Florida have any questions?

Mr. MACKAY. No, Mr. Chairman.

Mr. VOLKMER. The gentleman from California.

Mr. BROWN. Mr. Fink, I appreciated your statement. I think it was right on target as far as the kind of approach we ought to be taking to this problem of the development of space for man's use.

I might just ask as a procedural matter, in your role as chairman of the advisory council, do you have, shall we say, adequate opportunity to interact with the executives and administrators of the Agency to discuss the kind of a viewpoint that you have expressed in your statement here?

Mr. FINK. The answer, Mr. Brown, is yes. We have every opportunity to talk to Mr. Beggs. The associate administrators usually sit in almost our entire meetings. So there is a very good dialog.

The one task force that I briefly referred to in the opening of my statement deals with shuttle utilization issues, on how we can encourage its use, on how it could be marketed better, are there any procedural or technical things that could be done to make it easier to use by the commercial entities and so forth. So that is an example of a program we are actually working with the Agency.

Mr. BROWN. I perceive that what you are advocating here is a fairly pragmatic approach to a concept which can be described as a public/private cooperation in order to achieve the goals of our society, our economy and our country. By its nature, developing a pragmatic approach in a model of this sort causes problems. There isn't always a clear-cut precedent that you can look to. You can approach problems of this sort in a dogmatic way, or you can approach them in a more flexible way.

I hope the Congress generally adopts the position that in an area such as this we do need to be pragmatic. We are opening new ground and we don't really know the best way to do it. But you have quoted from the NAPA report. The report says, "The prospect for business ventures in space technologies represents a major opportunity to demonstrate that within the free enterprise philosophy there is a great potential for cooperative endeavor between the public and private sector" and that this could become a model for similar efforts in other areas.

We perhaps don't recognize—and I would just ask you to comment on this—that we are creating models of this sort all the time. I think maybe the best and earliest model was the system we created for Government and private enterprise to cooperate in agriculture, which was our biggest industry for most of the life of this country. We worked that out in a pragmatic fashion. It is not entirely a pure and free enterprise, and certainly it is not a Government effort to engage in agriculture. It is something that has tried to be mutually beneficial.

We have done similar things with energy, where we have stimulated, as I mentioned earlier to Mr. Beggs, a nuclear power industry which still is an example of public/private cooperation. We have done the same thing in the communications field in the area of communication satellites.

What I am concerned about—and I ask you as someone who has considerable experience in strategic planning—is whether we are really looking at policy, from the standpoint of assimilating and learning from all of those different pragmatic approaches we have taken, in considering what approach fits the needs of a new frontier in space. Are we looking at this in some kind of a realistic way? Frankly, when I see an effort by this administration to give away something like Landsat and the weather satellites, I don't see anything very pragmatic about that. It looks dogmatic to me.

I don't know how you feel about it, but you can tell me how wrong I am.

Mr. **Fink**. I like your word pragmatic. If you notice in my testimony, whereas this committee naturally raised some questions about the need for legislation, I attempted to focus down below. I attempted to express concern, which I do have—maybe because I've been around too long—that while the intention certainly of Congress will be there, and policies will be stated by probably the President and the Agency, when it gets four layers down for somebody to negotiate, amazing things can happen. Things can fall apart despite the best possible intentions. So I think the message I tried to get across is that we must carry through throughout the Government. Otherwise, my experience is that the planners that you talk about, the industrial people, are very, very conservative. If they can't see their way clear to a profitable venture, they will back off. It is going to take a great deal of attention to make space commercilization happen.

Perhaps where I don't necessarily see the need for legislation, I am sure there is going to be an oversight responsibility that Congress will want to continue to exercise.

Mr. **Brown**. Well, I am sure we will exercise very close oversight over this. But I am concerned as to how we can enunciate a policy which makes clear some of these subtle distinctions about when is the proper time to commercialize.

For example, you suggested that now isn't the proper time for shuttle operations because it isn't a mature technology. How do we tell when a technology is mature? What criteria can we establish in law or in regulation that will give some guidelines as to how we make these judgments?

Mr. **Fink**. I think it is very hard to come up with "cookie cutter" criteria. I think hearings such as this one, where you really draw out the best opinions that you can, is probably as good a route that I can think of to come to that decision.

The other way it comes, of course, is that the marketplace responds. In launch vehicles, there is suddenly a surge of propositions by companies, large and small, to provide such services. The question of maturity almost doesn't even enter because clearly the market has made the decision that the technology is mature enough for them to invest in. That is probably the best indication that one can get.

Mr. **Brown**. There are still examples that can be cited, where the market doesn't serve as a perfect mechanism until it is given some help. There are situations where markets are disaggregated, for example. There are other situations where a pure market analysis leads you to go in one direction, which may not necessarily coincide with the public interest. Of course, the obvious best example of that is where there might be defense implications or something of that sort.

I, frankly, have difficulty in my own mind reaching a formulation of criteria which apply in all these situations. I am continually looking for assistance in how to best make these judgments. Your testimony has been very helpful in that regard, but not perfect. I mean, you haven't spelled out all the details yet.

Thank you very much.

Mr. VOLKMER. Mr. Fink, in regard to a statement you made in answer to some of Mr. Brown's questions. When you get down to that lower levels of personnel within NASA, the ones doing the discussions with the private sector—and in the past have been doing it basically in an adversarial role—should those people need to be retrained in some way so that they are now looking for the commercial sector to work together, or to turn over matters to them?

Mr. FINK. No, I don't really think it is a question of retraining. It would be more a question of simply management carrying through than retraining. Let's suppose we're talking about the use of some Government facility—this was discussed at great length in your questioning of the previous witnesses—what the value should be. That person has been trained to try to extract the most value he can get, and rightly so. But in this case here, though, that kind of attitude could simply end up discouraging the use of the facility at all. If we are trying to encourage the use of the facility that would otherwise be mothballed or scrapped, perhaps that attitude has to change.

Mr. VOLKMER. But the management structure within NASA, especially if you have a commercialization office or something structured within it to oversee that type of——

Mr. FINK. Yes, I think so.

Mr. VOLKMER. In your opinion—and again, your statement is personal—once a technology has been clearly demonstrated in space, should it be considered immediately as a candidate for commercialization?

Mr. FINK. I am hesitating to make sure I understand the question. It certainly could be identified as a candidate for commercialization. I must worry about what the implications of that statement are, though, because if the implications are that that means the Government drops out once that decision is made, that may be a very incorrect judgment. In other words, it may require a much longer period of nurturing before the Government——

Mr. VOLKMER. Or you may have R&D in steps, too.

Mr. FINK. I guess perhaps the best example is aeronautics. Aeronautics is commercial; it has been commercial for 50 years. NASA is still involved in aeronautical research and development. One of the expressed purposes is to continue the leadership of this country in aeronautics. That responsibility is very well established. In fact, it was just recently reestablished by the Government policy. So there is a case where we have a commercial field in which the Government continues to participate.

The same judgment is going on, although with some fits and starts, in communications, communication satellites.

Mr. VOLKMER. Again, in response to your statement, on the question of "push and pull," should the public sector always wait for the private industry to come forward and say "this is what we want," or "we want to do this that you're now doing?"

Mr. FINK. No, I think there is a responsibility of, let's say, not pushing, but at least prodding and certainly educating on the possibility and making it easier to be effected.

Mr. VOLKMER. Should not NASA have some responsibility to identify what may be a commercial application?

Mr. FINK. Yes.

Mr. Chairman, take, for example, the general area of space processing which has been talked about for quite a while. I have a little concern that we may be accenting almost the PR aspects of that too much without recognizing that we really haven't done very many useful experiments yet in space. There is not much to go on. There has been a lot of talk for a long period of time, but the number of meaningful experiments has been very small.

I would be happy to have the talk about the subject backed up by more demonstrated results. I think that is going to happen, but it hasn't happened yet.

Mr. VOLKMER. Well, I guess it's like the chicken and the egg, unless you talk about it enough to get people interested in doing enough experiments, you're not going to have the experiments.

Mr. FINK. But if you talk too much and don't do anything, they get soured.

Mr. VOLKMER. I believe, according to Mr. Beggs, we will continue hopefully, to have more experiments in the applications and processing in space. Of course, I agree with you, that right now I don't think we have enough to say that it's here yet.

I have no further questions. That will conclude our hearings. Thank you very much, Mr. Fink.

The subcommittee will stand adjourned until tomorrow morning at 9:30.

[Whereupon, at 12:30 p.m., the subcommittee was adjourned.]

SPACE COMMERCIALIZATION

WEDNESDAY, MAY 4, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, D.C.

The committee met, pursuant to notice, at 9:33 a.m., in room 2318, Rayburn House Office Building, Hon. Harold L. Volkmer (chairman of the subcommittee) presiding.

Present: Representatives Andrews, Nelson, Brown, Dymally, MacKay, Walker, Chandler, and Lowery.

Staff present: Joyce Gross Freiwald, Mary Sanchez, Radford Byerly, Jr., and Gordon Smith.

Mr. Volkmer. Good morning. The Subcommittee on Space Science and Applications will come to order.

Today the subcommittee is holding the second in a series of hearings on the commercialization of space. The objective of the hearing is to acquire an understanding of the major issues associated with space commercialization. Later in the month we will focus on one particular issue dealing with the potential commercialization of expendable launch vehicles. These hearings are not intended to address Earth remote sensing and weather satellite issues: These will be taken up in separate hearings arranged jointly with the Subcommittee on Natural Resources, Agriculture Research and Environment.

After 25 years in space we are on the threshold of a new era, and in order to move forward and capitalize on our space technology base we need to evolve new contractual mechanisms and institutional arrangements that will foster Government/industry cooperation in space commercial ventures. For we must insure that the private sector has the freedom to organize and operate for profit in this new arena.

To date, NASA has been very innovative in working with those parts of the private sector that are willing to make an investment in space technologies. Today, we will hear from three companies that have taken advantage of NASA's willingness to cooperate with industry, and their various agreements and contractual arrangements with NASA will provide the focus for this hearing. From these discussions we hope to surface ideas that will help in the future, to smooth the transition of space technology from Government to the private sector.

We would like to welcome our witnesses today, the first of whom is Mr. David Hannah, Jr., the chairman and chief executive officer of Space Services Inc. Mr. Hannah's company was the first to develop a privately funded and operated launch vehicle which was successfully launched from off the coast of Texas in September of last year.

Mr. Hannah will be followed by Mr. Charles Ordahl, director of Space Programs at McDonnell Douglas' Huntington Beach facility. Mr. Ordahl will share with us some of the particulars that triggered and supported the development of the payload assist module. Two of these modules successfully transferred two commercial communication satellites from the orbiter Columbia to geosynchronous altitude last November.

Finally, we welcome Mr. Bruce Ferguson, vice president and general counsel of Orbital Systems Corp. OSC signed a joint endeavor agreement with NASA on April 18 which allows the company to proceed with the development of a transfer orbit stage. We look forward to your testimony, Mr. Ferguson.

Mr. Hannah, if you will take the chair and proceed.

At this time I would like to say that I have a conflict and I am not saying I am not interested—I am, and I will be right back. But I also have another hearing which I have to attend that also has a lot of impact on my district.

So at this time I would like for Mr. Andrews to take the chair and proceed.

Now, Mr. Hannah, your statement—do you have a prepared statement?

Mr. HANNAH. Yes, I do.

Mr. VOLKMER. It will be made a part of the record. You may either read it in full or you may summarize it.

STATEMENT OF DAVID HANNAH, JR., CHAIRMAN OF THE BOARD, SPACE SERVICES INC. OF AMERICA

Mr. HANNAH. Mr. Chairman, we certainly do appreciate the opportunity to appear this morning and present a little bit about our company and history.

We formed SSI for the purpose of commercializing space. Our initial objective was to go through the procedures necessary to build a launch vehicle and to determine the path that we would have to take to get the required approvals from the various agencies in the Government.

We did this successfully, I think, by launching the Conestoga I last September. And as a result of that launch we feel that we have pretty well determined that we can go through the Government bureaucracies and obtain all necessary permissions.

This last launch, we had to get approvals from NASA, the FAA, the FCC, the State Department, and, interestingly enough, the Bureau of Alcohol, Tobacco, and Firearms. We had to go to BATF because we imported a rocket into the country to test our guidance system, and we needed BATF's approval for the import of firearms. The latter requirement probably will not be duplicated the next time around.

We feel that the Government could take three actions to help us continue with our commercial program. First we feel that if there was a clear-cut, streamlined regulatory path—if we knew where we had to go and who we had to deal with and what we were required to do—we could obtain our approvals in a much more efficient way than in the past. If we increase the number of people we have to brief and get approvals from—a trend already evident from the first time we went through it to the Conestoga I launch—we would have to deal with a lot more Government agencies and incur additional costs. By having one lead agency that would deal with us and give us the criteria for obtaining necessary approvals, we feel the regulatory process would be streamlined. We have worked very successfully in the past with the FAA. The other agencies certainly have been very cooperative and very helpful; we couldn't ask for any more support than we have received. I think that we aren't being critical of any other department when we say that we feel that the FAA would be the logical choice to be the lead agency for approving private rocket launches.

Second, we feel that the Government could help us by not competing directly or indirectly with the private sector. SSI can compete on a service basis, taking individualized approaches to customers and giving the kind of service that customers need and want. But we don't feel that we can come in and compete with a Government-created and subsidized program that sustains an artificially low cost of operation. The concept would be that if the private sector were able to undertake a particular project and complete it successfully, the cost of the program would be determined and the market would set a price. If the Government would then recognize that cost and price and not come in and subsidize a Federal agency or contractor who would compete with us at a lower cost, I think that such a policy would allow us to be competitive through service—just servicing the customer in a better way.

Third, the Government should support research and technology development. NASA has been tremendously helpful and exciting in the way that they have developed different technologies and made them available to us in a very cooperative way. NASA has been very helpful to us; any technology that we have needed has been available to us. We think that that policy should be continued whenever possible.

The way that NASA transfers technology and know-how, gives us the opportunity to better understand what needs to be done. If we have a problem we can usually go and find where that has been addressed in NASA in the past. But to continue the process after a technology is past the research and development stage and into commercial application, I think that's what we are hoping we can be able to do, to take over the actual operation of the commercial sector. There is a business to be made, to go in and service existing and future markets with the technology that has been developed by NASA and to continue to do so on an economic basis.

So to summarize the three different areas, if we had a clear path of regulation, if we are not required to compete with a subsidized agency or firm, and if we have a clear path to Government-supported research and development, we feel that we can conduct a commercial operation effectively and on an economic basis.

We see the role that NASA does and does so well in research and development continuing, including turning over to the private sector for commercialization only those technologies and services that the private sector is willing to pick up and start marketing.

And in that way the private sector is able to carry on—our sucess is determined by whether the market really is there land whether the market can sustain that commercial operation.

We feel that we have a launch vehicle that can be developed on a commercial basis. We would not be competitive with the shuttle in any way. We feel that we would fill a market niche in that commercialization of launch vehicles that would allow us to be competitive and commercially operated and oriented.

I think those are the three main areas that we would be concerned with, the market, the regulations, and the research and development transfer.

[The prepared statement of Mr. Hannah follows:]

TESTIMONY

OF

DAVID HANNAH JR.
CHAIRMAN OF THE BOARD
SPACE SERVICES INCORPORATED OF AMERICA

BEFORE THE

SPACE SCIENCE AND APPLICATIONS SUBCOMMITTEE
COMMITTEE ON SCIENCE AND TECHNOLOGY
U. S. HOUSE OF REPRESENTATIVES

MAY 4, 1983

Mr. Chairman and distinguished members of the Subcommittee, I am David Hannah Jr., Chairman of the Board of Directors of Space Services Incorporated of America (SSI) of Houston, Texas.

I am pleased to have this opportunity to testify before you today on a most important topic: how government and industry can cooperate to fully tap the great national economic and social potential of the commercial development and application of space technologies. SSI believes that space represents a virtually unlimited frontier for economic growth--a frontier that the American free enterprise system is uniquely qualified to develop.

Space Services is a small company, founded in 1980. SSI's corporate objective is to use proven entrepreneurial techniques as a means for the private sector to help transfer governmentally developed space technologies to industrial and commercial applications. Our initial project is the development of a low-cost commercial launch vehicle--the Conestoga. On September 9, 1982, SSI became the first American company to successfully launch a rocket into outer space. The Conestoga I suborbital flight accomplished all mission objectives, including a demonstration of the ability of the company and the vehicle to inject a satellite into orbit. We now are proceeding with our plans to build an orbital launch vehicle and to place a commercial satellite into low Earth orbit in late 1984 or early 1985. Conestoga II is designed to launch a variety of relatively lightweight, low-orbiting satellites to provide remote sensing, data collection, and positioning services. We believe for several reasons that the Conestoga will complement, not compete with, the Space Shuttle and other expendable launch vehicles.

I mentioned that the Conestoga I mission met all of its objectives. In my opinion, one of the most significant accomplishments of Conestoga I was the demonstration of a private company's ability to obtain all governmental licenses and permissions necessary for a private sector launch. SSI received formal approvals from five federal agencies: NASA, the Federal Aviation Administration, the Federal Communications Commission, the Department of State, and the Bureau of Alcohol, Tobacco, and Firearms of the Department of Treasury. SSI cooperated informally with the United States Navy, the Coast Guard, and NORAD. In breaking this new regulatory ground, each of these agencies demonstrated both a remarkable degree of flexibility and a strong support for the concept of private space operations.

NASA and the FAA, in particular, were willing to work very closely with us in support of the Conestoga mission. Moreover, NASA's decision--with the consent of this subcommittee and others in the Congress--to sell us a solid rocket motor from their sounding rocket program inventory ultimately enabled SSI to undertake the Conestoga I mission. In many ways, then, I believe that Space Services' success is one rightly shared by the U. S. government and all our fellow citizens.

As we look to the future of commercial space operations, I believe governmental policy will continue to play a pivotal role. It is both symbolically and substantively imperative that the government send a clear signal encouraging the growth of this emerging high technology industry. Space applications are particularly capital-intensive, and investors carefully scrutinize all risks before providing seed capital for commercial space programs. The two greatest risks confronting almost any commercial space venture--market size and acquisition of governmental approvals--are fundamentally influenced by governmental policy. Moreover, the viability of this industry in the coming years will be subject to the impacts of government programs or policies that encourage or discourage research and development of advanced space technologies and/or the subsequent transfer of such technologies to commercial entities. I would like to comment briefly on each of these three areas--regulation, market, and research and development and its transfer into commerce--as they relate to government policy.

Regulation. One of the clearest positive signals the government can send to the private sector is a serious effort to clarify and streamline the myriad applicable regulations and to coordinate the numerous agencies with authority over private space ventures. As I noted earlier, all of the government agencies working with SSI were very supportive and flexible in navigating these heretofore uncharted regulatory realms. Such cooperation was essential, because in current practice a negative opinion from any government agency would effectively prevent a private launch. Consequently, the fact that we received permissions from all interested agencies is itself a strong indicator of governmental support.

However, SSI did expend a great deal of time, effort, and money to obtain those permissions. We received the final license only one day before our scheduled launch date, six months after we began the multiple-applications process.

We already are beginning to identify and investigate the licenses and permissions required for our next mission. In 1981 our first attempted rocket launch (of the Percheron) required licenses from the FAA and the FCC. As I noted, in 1982 the Conestoga I required five formal permissions and several additional cooperative arrangements. Our next mission will place a commercial satellite in orbit, which may further complicate this process--although at this point I cannot say with certainty which, if any, additional licenses or permissions will be required.

Early delineation of a reasonable regulatory regime for commercial space ventures constitutes one essential component of a governmental policy designed to encourage greater private sector involvement in space applications and operations. While a comprehensive analysis of specific improvements in the regulatory process is probably beyond the scope of these hearings, I would like to note that this committee has before it at least one legislative proposal (H.R. 1011) designed to streamline the launch approvals process. I would encourage this committee, as I did in my previous testimony in September 1981, to promptly address the need for a single federal agency with overall responsibility and authority for licensing private sector space launches, launch sites, and satellite applications. I continue to believe that the Federal Aviation Administration--which functioned so effectively both technically and administratively for the Conestoga I launch--is best qualified to play the lead agency role, supported by proper inputs from other government agencies, including NASA.

Market. Any entrepreneurial space venture also faces a second risk factor, the market for commercial space applications and the presence of competitors for a given market. Because space technology traditionally has been developed and operated by the government, it is understandable that the principal competitor for any entrepreneur in commercial space applications (with the exception of communications satellites) is the U. S. government--for example, in transportation, NASA; in remote sensing, the National Oceanic and Atmospheric Administration; and in navigation/positioning services, the Global Positioning System of the Department of Defense.

It is extremely difficult to propose a formula for commercial development that would balance the expectation of many that the government should endeavor to recover as much of the taxpayers' investment in space applications as possible with the equal if not more important need to encourage increased private sector investment in space operations.

I believe that the nation is at an important transition point in the commercial application of space technologies. Crucially, industry and government must find mechanisms which promote government/industry cooperation rather than competition in the internationally competitive marketplace for commercial space applications.

Mr. Chairman, industry should not expect large direct subsidies to encourage commercial space technologies, but, concomitantly, industry should not be forced to compete against government-operated space systems that are effectively subsidized by taxpayer dollars. In this time of very real national budgetary constraints, the government must formulate criteria enabling NASA and other federal agencies to continue to operate space systems critical to the nation's needs, while simultaneously preserving industry opportunities to enter the marketplace and satisfy predominantly commercial needs. I am not suggesting that the government has no right to offer its services to commercial users, but rather that we must find procedures to ensure that the government does not subsidize inefficient space operations and applications, thereby functionally precluding industry from offering more cost-effective alternatives.

I believe that government and industry can develop a consensus on an overall hierarchy of government and private demand for space operations and criteria for meeting those needs. For example, industry should address purely commercial needs by providing services according to market dictates. We should look first to industry to satisfy needs which include both commercial and scientific/research components. If no purely commercial service is forthcoming, the government then should consider a range of responses to ensure that the necessary service is provided. Perhaps the first response should be an effort to jointly develop and/or apply the technology, e.g., NASA's joint endeavor agreements. A second response might be a series of inducements (for example, tax incentives) for industry to provide the needed technology or service. Direct government funding for the technology or service in question should be the last response, and the government should fund such operations only as long as industry is unwilling or unable to supply the service or technology. Furthermore, when the government offers commercial space services, every attempt should be made to recover all associated operating costs. This policy will promote efficiency in government procurement and operation of space systems. Finally, the government may want to continue direct funding of scientific or research and development needs, or policymakers may want to examine the feasibility of offering sufficient inducements to industry to encourage basic research and efficient and innovative R&D.

Mr. Chairman, I offer these suggestions only as a starting point for what I believe is a most important discussion on building industry/government cooperation rather than competition. These suggestions may be facile or unworkable, and I'm certain that others in industry and government will have useful insights. However, in my judgment it is essential that we incorporate the potential contributions of a new generation of space industries--those willing to take risks to provide commercial space technologies and services--into our evaluations of current and planned space technologies and services. Only by encouraging such space entrepreneurs can our nation truly take full advantage of its investment in space--an investment that has demonstrated new markets and paved the way for a new sector of economic growth to improve the lives of future generations.

Research and Development and Transfer Policy. I often have said that Space Services would not be here today if it were not for the government's substantial long-term investment in space technology research and development. I believe that commercial space applications will fulfill their great economic and social potential only if the U. S. government continues to invest in advanced research and development of new space technologies--particularly long-term, high-risk, high-cost, ground-breaking R&D. I can think of no better recipient of precious taxpayer dollars for this purpose than NASA.

Of course, it is equally important that the products of R&D are effectively transferred, when appropriate, to the private sector for further application and commercial development. The appropriate timing of such transfers is often difficult to determine, but I believe that such transition difficulties are outweighed by the advantages of government R&D, competitive private commercial space activities, and cooperation between the government and the private sector to achieve smoother transitions. NASA already has taken important steps to facilitate the transfer of R&D products to the private sector, and I would encourage even more efforts in this area. Specifically, I believe that NASA should promptly act to transfer expendable launch vehicle operations to the private sector. Although ELVs can hardly be classified as a "new" space technology, their transfer at this time (under the proper conditions) could generate an important private capability to back up the Shuttle. In the case of new technologies such as advanced solid state sensors for remote sensing applications, NASA should actively solicit industry input at an early stage in the planning process to help identify workable technologies and useful programs. Subsequently, NASA should make every effort to supply research results in a timely fashion to any interested company. Whenever possible, governmentally developed space technologies should be available to any interested party at cost. In those instances where only limited access is possible (for example, use of government launch facilities), it is imperative to avoid monopolies and give equal opportunities to financially and technically responsible small companies, as well as to well-established large corporations. By promoting the entry of new entrepreneurial companies into the space industry, government policy can do much to bring growth, flexibility, and productive innovation to commercial space operations.

Finally, Mr. Chairman, your letter of invitation specifically requested my comments on the NASA/industry partnership to develop commercial space technologies and services. As you no doubt can discern from my testimony, I believe NASA has played and will continue to play an important role in encouraging commercial space ventures. In the future, NASA can provide important technical insights to the lead regulatory agency for licensing private space operations. To promote the development of private markets, NASA must carefully scrutinize each existing and new technology and/or government commercial space service, seeking to minimize competition between domestic industry and the government. To strengthen the underpinnings of private and government space activities, NASA must continue its efforts to lead the world in advanced space technology research and development--and, subsequently, NASA must disseminate that technology in the widest practicable manner, paying particular attention to the needs of small, entrepreneurial space development corporations.

Thank you, Mr. Chairman, for soliciting my views on this most important topic.

Mr. ANDREWS. Mr. Hannah, just let me welcome you to our committee. Since most of your family lives in my district and we are both from Houston, I am delighted to have you appear before us this morning. All of us in the Houston area watched with great admiration your first launch. I think this committee is very eager for you to succeed.

I just have a few questions.

In 1985, France intends to send their SPOT, their government-subsidized land remote sensing satellite up. How can your company compete with foreign countries like France that will be subsidizing competition?

Mr. HANNAH. We feel that we can do it by service. And the three areas that we begin with, I think, are in the Earth-sensing area. We feel that if we come up with a sensor which we have designed and can operate commercially, that sensor would allow us to give a particular service to a particular segment of the industry. We can sell that information to the users in one of three forms. We can market the row data to customers, just as it comes down; we can process the data to a certain degree; or we can give a final service to the customer, such as a combination of informations put together in a certain way, so that we could deliver the completed project.

I think that we aren't going to be able to compete with a subsidized Government program, either foreign or domestic. But I think by taking the information and by processing it in a way useful to the customer and servicing the customer, that we can be competitive in this service industry.

We think remote sensing is an expanding market, one that I think should expand very rapidly. And I think that the key to success is not going to be cost so much as service. If we can supply this service, I think that we can certainly be competitive in the business.

Mr. ANDREWS. In the same sense, NASA is developing a new scanner called the multilinear array, which is a lot more accurate than either of the land remote sensing scanners currently being used.

If NASA puts the scanner up in orbit permanently as an experimental project, how, again, can you compete against what would be, I assume, more accurate data?

Mr. HANNAH. Well, we would hope we could use that data and then supplement it with some data of our own, and blend that into our business.

Again, I would say, I think the market is large enough, but we can't compete with a Government-subsidized program. But we could be supplying our service plus blending in other information with our own service. So we feel that such data could complement each other rather than being competitive.

Mr. ANDREWS. Finally, I wonder if you would care to comment on what tax incentives you think would be beneficial to your group in encouraging private industry.

Mr. HANNAH. Well, I think that there is certainly a legitimate role for taxation to play in encouraging projects that the Government wants to happen or that the private sector would like to have happen by giving tax incentives. If we look at the three stages of the development, the role is clearer. If a technology is fully commercial, where there is a clearly defined market that is commercially oriented, I don't think that needs to have any tax incentives. If you wanted to encourage applications, some additional element of it that would develop some new technique or enlarge on an existing technique, you might give some research and development taxation benefits there that would allow us to investigate applications on an incentive basis.

Then, of course, when you get into the phase of it where it is purely research and development, you could try a tax approach that would ofter a tax incentive, and if that didn't do it, then if you still wanted to have it done, if it was something the country needed, then I think that NASA could carry on and do the pure research and development work that needed to be done.

Mr. ANDREWS. Mr. Nelson?

Mr. NELSON. Thank you, Mr. Chairman.

Good morning, Mr. Hannah.

Mr. HANNAH. Good morning.

Mr. NELSON. Tell me now, what is your plan for the future? You have had Conestoga; you want to launch another Conestoga in about 1985 or so.

Mr. HANNAH. Yes, sir.

Mr. NELSON. Then do you want to get into the Deltas and the Atlases and so forth? Is that your plan?

Mr. HANNAH. What we are hoping to do is primarily concentrate on the launching of our orbital vehicle with an Earth sensing satellite on it early in 1985. That is our primary thrust, our main direction right now. We are certainly willing to look at anything that has a commercial application in space. If there are opportunities in these other fields, we would certainly like to explore them.

But our main course is the orbital vehicle in 1985 along with our Earth sensing satellite, which would really supplement the work that is now being done with Landsat.

Mr. NELSON. Do you feel that it becomes profitable for you just with that launch in 1985 with all of the up-front money that you have had to put out?

Mr. HANNAH. We have made some market studies that indicate that there is a market if we property service the industry. It isn't there now. We couldn't go and look at what is being done now and say that market is there and we are going to get a part of it. But we feel that by giving additional service and really adopting the customer and orienting our activities toward the customer that we will be able to enlarge that market.

It is not a market that I think is going to be a frivolovs market. Remote sensing is a value-added market where, when we give this service to the customer, the bottom line is some benefit that will be cost effective. So we think that the market will expand as we have this service-oriented approach to the Earth sensing field in place.

Mr. NELSON. And who would be some of your customers?

Mr. HANNAH. The oil companies would be some of our customers, as would the Third World nations that are beginning to develop their resources and the companies that deal in renewable resources, such as the grain and the timber companies. Then in the management of water there is a tremendous amount of work that could be done through monitoring the use and the flow of water, making more effective use of our water supply, which is becoming increasingly scarce.

Mr. **NELSON**. This orbital camera from which you would provide these services, how would it duplicate or be different from existing cameras that we have up there, such as Landsat?

Mr. **HANNAH**. I think what we are doing is just taking a portion of the work that NASA has done, which is, I think, the way we have been working with NASA—and it has worked very effectively. We take just the part of the technology and/or technique that we need to service a particular portion of the industry and design our sensor to accomplish that objective. By limiting our objectives to a certain clear-cut program, we can cut the cost down and get it done more cost effectively.

That is what we hope to do, to take portions of the work that has been done in this field, zero in on a certain customer's need, and then supply that service to the customer.

Mr. **NELSON**. And at this point you haven't defined that objective?

Mr. **HANNAH**. Yes, sir, we have. Our sensor is pretty well defined, and it is going to be supplying data to companies that can use information to locate and develop mineral deposits, analyze crop growths and timber growths, or monitor the locations of the water supplies.

Mr. **NELSON**. This is a scheduled launch for what date?

Mr. **HANNAH**. It would be early in 1985, I think.

Mr. **NELSON**. At what point do you become break even with all of the costs that you have incurred thus far?

Mr. **HANNAH**. Our projections—and they are projections based on the market expanding—would show us going positive around 1987, 1986, or 1987.

Mr. **NELSON**. You break even, you say, in 1986 or 1987, and then you have got a life of how long for that satellite?

Mr. **HANNAH**. We hope about 3 to 5 years at that range. We also projected that if the market expands as we think that it will, we would launch two other satellites. So we will eventually end up with three satellites, replacing those as they wear out. So our program, I think, will be ongoing.

We hope to be able to bring the technology along as we do subsequent launches. So we will have a series of launches that will take advantage of new technologies and techniques that are coming along.

Mr. **NELSON**. Now, all of those launches would occur on a Conestoga vehicle?

Mr. **HANNAH**. Yes, sir, they were designed for our Conestoga vehicle.

Mr. **NELSON**. They would be launched from—where are you in Texas—Matagorda?

Mr. **HANNAH**. Well, we are on Matagorda now. That would not be an ideal launch site for our first orbital mission. We are now talking of a site over in Mississippi, so that we can get further around, so that when we make the polar launch—all of these remote sensing satellites will be launched polar—we can stay over the Gulf of Mexico.

Mr. **Nelson**. Have you discussed with NASA about launching from the Cape?

Mr. **Hannah**. No, sir, we haven't. We would prefer to have our own private launch site, because we don't need all of the extra things that would be required if we were on a Government launch site. We think that the way we conducted ourselves down on Matagorda shows that we can act in a responsible way and conduct a responsible launch with minimum facilities.

Mr. **Nelson**. Is your 1985 launch going to be from Matagorda?

Mr. **Hannah**. No, sir. The 1985 launch I think will probably be—hopefully, but I don't know—from the Mississippi coast.

Mr. **Nelson**. Go into polar orbit?

Mr. **Hannah**. It will be a polar orbit, yes, sir.

Mr. **Nelson**. Is your organization the one that Deke Slayton is involved in?

Mr. **Hannah**. Yes, sir. He is our president.

Mr. **Nelson**. All right, now, given your plan of operation, what do you think about the commercialization of other expendables and the ability of commercial enterprises to launch from the Cape?

Mr. **Hannah**. I think that if we use the concept that we would like to suggest as a sound one—where NASA would do the research and development until the commercial sector could take it over—we would see an application to what is happening in the expendables. NASA developed and used the expendables for a while, and no one else wanted to do it.

I think there is some feeling now that there could be some commercialization of these expendable vehicles. I feel that the private sector should be given an opportunity to see if there is a commercial market that they could sustain with those expendable vehicles. That would be a good supplement and a good backup to the shuttle program; the shuttle could perform the things that it can do uniquely, and the expendables would be available on a commercial basis to the customers that can't be taken care of on the shuttle.

Mr. **Nelson**. All right, one final question, Mr. Chairman.

You know, we have had some proposals made by the administration with regard to turning over our weather satellites to a commercial enterprise. Do you have any opinion on that?

Mr. **Hannah**. I think that the weather data are such an integral part of the Government's program that it would be very hard to commercialize that. I would think that that would be something that would be awfully hard to do, and it shouldn't be done, I think. The Government certainly should perform that service.

Mr. **Nelson**. Were that to be done, would they in any way be competition for you in what you plan?

Mr. **Hannah**. I don't think so, sir. No, sir, I don't think they would be. We certainly will use the weather satellite data in our interpretive process, and we would like to have access to them.

Mr. **Brown**. Would the gentleman yield?

Mr. **Nelson**. Certainly. I yield to my distinguished friend from California.

Mr. **Brown**. The question the gentleman raises, I think, has to be considered in the context of the proposal made, which is both the meteorological satellites and Landsat. If you do include Landsat I think it would represent some competition for your operation, would it not, Mr. Hannah?

Mr. HANNAH. Well, we hope that the market will expand enough to where there will be business for both of the operations. We certainly are going to blend the information that Landsat is giving us into our program. And when we offer final products to a customer we will have incorporated the Landsat information that we have obtained.

So I see it more as a supplement, and we certainly wouldn't mind working very closely with anybody who commercialized the Landsat, or we might even make a proposal to the Government that we work with them on Landsat. But our program would be supplementary, I think.

The Landsat is a research and development program that I think is very, very complicated, and Landsat is a very exciting kind of an instrument—but not the kind of technology you could ever turn into a commercial operation, because the initial cost is so very, very high.

Mr. NELSON. Thank you, Mr. Chairman.

Mr. Andrews. Mr. Chandler.

Mr. CHANDLER. Thank you, Mr. Chairman. I knew you were a member of our class on the way to the top, but I didn't expect to see you there so soon. Congratulations.

I would like to ask just one question, sir. On page 5 of your prepared testimony, you, say that industry and Government must find mechanisms which promote Government/industry cooperation rather than competition in the internationally competitive marketplace for commercial space applications. This raises the question—and you have addressed it to some degree in your remarks—what obstacles do you foresee in the way of this competitive marketplace, and your ability to work in this area? As a follow on question to that: How do you think that utilization of NASA and its services should be reimbursed? How do you feel that you, the private sector, should reimburse them? What sort of a relationship should this be?

Mr. HANNAH. Well, we hadn't really thought about reimbursing NASA for their advisory services. I hope that that wouldn't be necessary. They have been so helpful to us, and it has been so helpful that we would be kind of dependent upon the continuation of that type of relationship with them.

I look at NASA as kind of a national treasure that we can all have access to. And as we gain access to that knowledge and get the benefit of what NASA has done, and enlarge up on it, and use that as the base in beginning our commercial operation, if we are creative enough in what we can use that information for, and the market expands as rapidly as we think that it can expand, I think that blending together—the Government giving us a base from which to operate, and then we go ahead and carry on with that—is a very productive way to do business and a very productive partnership.

Mr. CHANDLER. Does that call for some type of an information clearinghouse? Is that what you are suggesting?

Mr. HANNAH. I think we have already got that, because NASA has made available to us—and to anybody—any information we have needed from them—they have been very gracious in giving it to us. So I think there is that clearinghouse. It is there, and I think it is operating very well.

Mr. CHANDLER. Thank you, Mr. Chairman. I will yield the balance of my time.

Mr. ANDREWS. Mr. Brown?

Mr. BROWN. Mr. Hannah, I am quite interested in the product that you are going to be trying to sell, this remote sensing data. I am not quite sure I understand the quality of the product yet. I wonder if you could describe exactly what it is and how it differs from the Landsat data.

Mr. HANNAH. Well, the first satellite is really selecting just a portion of the Landsat data bands. We are using sensors that will help interpret the types of crops that are being grown, determine the major characteristics of areas on the Earth, and find major faults and associated structures through the interpretation.

We are going to have a stereo data ability. When we "take pictures," we will have the ability to put data on the three dimensional plane, giving a three-dimensional aspect to the interpretation that will be given to customers such as the oil companies. By using this method we can give the oil companies the ability to pick up the major fault patterns, which is a good way of finding new oil accumulation. We will be able to tell different countries what crops are being grown, which ones are healthy, and which ones are diseased. We will be able to locate the major water courses and the major places where water may be available through exploration.

So what we are doing is just taking a portion of the Landsat technology and putting it into a simpler system with no moving parts and lowering the cost that way.

Mr. BROWN. How are you returning the data to Earth?

Mr. HANNAH. Through a transmission back down to a ground station. It may be sent to the ground station that NASA uses or to one of our own. We won't have a recorder onboard, so we will have to have a ground station near enough to where the data is being picked up to receive it and process it on the ground.

Mr. BROWN. How about resolution? What level of resolution will you be getting?

Mr. HANNAH. It is not going to be as detailed. I think it is 40 meter resolution.

Mr. BROWN. Forty?

Mr. HANNAH. Forty, yes, sir.

Mr. BROWN. Well, that is better than Landsat has been, but it is not as good as SPOT.

Mr. HANNAH. I am sorry, it is six bands at 80 and two bands at 40 meter resolution.

Mr. BROWN. In developing the specifications for your equipment, I suppose you worked with the petroleum industry and the Geosat Committee to determine what the petroleum industry would find most useful for them?

Mr. HANNAH. Yes, sir, we have been working with the petroleum industry. We have taken their needs into consideration.

Mr. BROWN. Because I recall discussions with them several years ago in which they were talking about Landsat and what the next generation technology should be to meet their needs. NASA wasn't giving them quite what they wanted, as I recall.

Mr. HANNAH. Yes.

Mr. BROWN. Particularly the stereoscopic data.

Mr. HANNAH. Yes, that's right.

Mr. BROWN. You are going to be able to provide them with that kind of data?

Mr. HANNAH. With the stereoscopic data, yes, sir, we are.

Mr. BROWN. All right, now, that is probably the most fully developed aspect of the Earth sensing market. That is, you have got a customer group there that knows what they want pretty well and has the money to pay for it.

How much additional work have you done in developing a market for the product that you are going to be able to provide?

Mr. HANNAH. We have done quite a bit of work in the Third World nations trying to see what they need as far as their resource development is concerned, and they have expressed quite a bit of interest. That seems to be an expanding market. We think that the commodity companies are going to have a real need for this data, where you can determine the crops—for example the wheat crop, what amount of wheat is going to be grown in any given year.

Mr. BROWN. But you are competing with the LACIE program when you do that. The Department of Agriculture is probably ahead of you in the technology and the data that they can offer.

Mr. HANNAH. Yes, sir. And I think all we would be doing is just putting it in a form that would be a service to the industry, meeting the needs of the customers a little bit more than is being done now. It would be a service-oriented sort of thing.

We think that market will expand as people realize the full significance of what they have got here.

Mr. BROWN. Let me ask you just one additional question. In your discussions with underdeveloped countries, have you run across any problem with the highly delicate diplomatic problem of your right to oversee—overfly their country and take pictures of it?

Mr. HANNAH. We have been working with the State Department on that, and I think that will be an issue that we will have to address. We feel that by not having the recorder on our Earth sensor, that will alleviate those fears somewhat. But I think that is something that will have to be addressed and we will have to work on it. We will certainly be sensitive to that in that program.

Mr. BROWN. Well, I want to compliment you on what you are doing. I personally feel that there is a very large market, and as you get further into it you will find it expanding dramatically. I hope you will be able to reap the benefits from that.

Mr. HANNAH. Thank you, sir.

Mr. BROWN. I may want to invest in the company a little bit later. [General laughter.]

Mr. HANNAH. Thank you, sir.

Mr. ANDREWS. Let's take a 15-minute recess to go and vote.

[A brief recess was taken.]

Mr. ANDREWS. If we could call the meeting back to order, I would like to yield to the chairman of our committee, Mr. Volkmer.

Mr. VOLKMER. Thank you very much, Mr. Chairman.

Mr. Hannah, from reviewing your testimony and some of your answers to questions already, I think I know some of the answers to my questions but I would like to have them for the record anyway.

Mr. HANNAH. Yes, sir.

Mr. VOLKMER. As you know, there is a possibility that in the future we will spin off the Landsat operation from the Government to the private sector.

Mr. HANNAH. Yes.

Mr. VOLKMER. I was wondering if your firm plans to respond to the requests for proposals on that?

Mr. HANNAH. I think we would like to have a little bit more information about the ground rules before we would respond. I think it certainly fits in with our program, and we could certainly look at it from that light. But I think we would like to reserve whether we would respond or not until we get more information, sir.

Mr. VOLKMER. In other words, you would have some interest in taking over that operation, then?

Mr. HANNAH. Under certain conditions, yes, sir.

Mr. VOLKMER. All right.

Were you furnished with a request for information from the Department of Commerce and NOAA back last year? Was your company given one of those requests for information, do you know?

Mr. HANNAH. Can I ask Mr. Chafer about that?

Mr. VOLKMER. Sure.

Mr. HANNAH. Yes, sir, we did.

Mr. VOLKMER. And did you respond to it?

Mr. HANNAH. Yes, sir, we did.

Mr. VOLKMER. All right, so you do have some interest in it, then?

Mr. HANNAH. Yes, sir.

Mr. VOLKMER. Let me go one step further, then. Would you be interested in a request for a proposal providing for both the Metsat or weatherization satellites, and Landsat together in a proposal?

Mr. HANNAH. No, sir.

Mr. VOLKMER. You would not be interested in that?

Mr. HANNAH. No, sir.

Mr. VOLKMER. Now, in your statement you state that in your opinion the FAA would be the proper lead agency for handling licensing for private operations of expendable launch vehicles. Is that correct?

Mr. HANNAH. Yes, sir.

Mr. VOLKMER. Can you give me your reasoning for that expression of opinion?

Mr. HANNAH. Well, part of it is the experience we have had, of course. We worked with the FAA in our last launch, in our first attempted launch, too. And it was a very satisfactory relationship. I don't want to say that we are not willing to work with other agencies, it is just that we have had that good experience with FAA. We feel that they are an action agency; they are used to dealing with the kind of concerns and business that we would be dealing in. So it was a logical thing, we felt, that they would be kind of carrying on with what they are accustomed to doing.

FAA is the agency, I think, that would be more action-oriented than any other agency.

Mr. **Volkmer**. Of course, they have been active for years in aeronautics and in operation of common carriers, et cetera. But they haven't been, basically, in space. But you found as your experience in working with them on your first launch vehicle that they were very helpful then?

Mr. **Hannah**. Very helpful sir, yes.

Mr. **Volkmer**. In your first launch you used, what, a Minuteman, basically?

Mr. **Hannah**. Yes, sir. We acquired the rights to use that technology from NASA, and that vehicle was developed around it.

Mr. **Volkmer**. What do you plan to use in your second launch?

Mr. **Hannah**. A commercial variation of that motor configuration. And we have yet to decide on the supplier of that, but we are negotiating with two or three suppliers.

Mr. **Volkmer**. But basically you will use an existing launch vehicle?

Mr. **Hannah**. Yes, sir.

Mr. **Volkmer**. In other words, you are not designing your own launch vehicle, then, and engines, et cetera?

Mr. **Hannah**. We are designing our configuration. It will be a little bit different than any that are existing now, but we are using off-the-shelf technology as far as the propulsion system is concerned, yes.

Mr. **Volkmer**. Fine.

Now, of course, you worked also with NASA during the licensing and launch of your first vehicle?

Mr. **Hannah**. Yes, sir.

Mr. **Volkmer**. I would like to know if you believe that NASA should establish a commercialization office within the NASA structure, for commercialization of space technologies, et cetera, that can be used in the private sector.

Mr. **Hannah**. That would certainly be helpful, I would think, sir, because then we would know who we had to deal with, and it would make contacts a bit easier. We dealt with lots of different people in NASA and got very good cooperation, but it certainly would be easier to know exactly who to go to see.

That would be consistent with our concept of trying to streamline the process.

Mr. **Volkmer**. All right.

Do you have any specific suggestions for streamlining the Government's decisionmaking process when considering proposals such as yours, besides setting up a lead agency?

Mr. **Hannah**. I think that you need to define exactly what we have to have done, so that we could know what we had to cope with and we could plan ahead and anticipate the difficulties—if there were any difficulties—as far ahead as possible.

Mr. **Volkmer**. In other words, whatever agencies you needed to have approval from or have to go through for clearances and things like that?

Mr. **Hannah**. If that were clearly understood it would be very helpful, yes, sir.

Mr. **Volkmer**. In kind of a step-by-step procedure?

Mr. **Hannah**. Yes, sir. And then once we had done that, if we could duplicate the process if we launched again, we would know where to go and how to do it and how long it would take to have it done.

Mr. VOLKMER. And anybody else would, also.

Mr. HANNAH. Yes, sir.

Mr. VOLKMER. Any other firm or organization?

Mr. HANNAH. Yes, sir.

Mr. VOLKMER. OK. I have no further questions. Thank you, Mr. Chairman.

Mr. ANDREWS. Thank you.

Just in following up on that, what should the Government concern itself with in the licensing requirements?

Mr. HANNAH. I think that the Government should: be safety conscious; require that we have adequate insurance; make sure that we are not violating any international treaties; insure that we are conducting ourselves in a responsible fashion; and verify that we are using the technology for peaceful purposes. Those are the primary things I think the Government would be concerned with.

Mr. ANDREWS. In what areas should the Government not be concerned?

Mr. HANNAH. I think the cost that we charge. We would like to have a private launch site, where if we met the Government's criteria we could launch from our own private launch site. I think we would like to think that they wouldn't be concerned with having to be in charge of our launch facilities.

I think that is primarily it. Once they set the guidelines and we have to live within those, I think the Government then could say that if we meet those criteria, we can launch.

Mr. ANDREWS. You mentioned safety requirements a while ago. What changes do you think that the Government should make in safety requirements?

Mr. HANNAH. Well, they have got, I think, the range safety policy that they use at the Cape now. That is, I think, a good criterion to go from. And I think that that should be adhered to. There are some regulations with regard to international law that I think would probably be better if they were changed.

For example, I think right now that the Government is liable for any spacecraft that lands overseas, but they are not responsible for any aircraft that lands in a foreign country. I think that should be reviewed to see if we couldn't put that more under the category of airplanes.

Mr. ANDREWS. Mr. Chandler?

Mr. CHANDLER. Mr. Chairman, just a quick followup. Ms. Freiwald and I were just talking—when I asked you the question about compensation to NASA, what I was referring to was for use of facilities. You responded to a question about use of information. I really should have caught that at the time. But I didn't want to leave in the record a confusing question to one point and an answer to another that would put you in the position of looking like you don't want to pay for anything that you get from NASA.

So you might comment on that. Should it be like buying a ticket on an airplane? Should it be a share of the total cost, including capital? How do you feel about use of the facilities themselves and the compensation for that by private industry?

Mr. **Hannah**. Thank you for letting me clear that up, and I appreciate you asking that question, sir.

We did compensate NASA for the use of technology as far as our solid rocket vehicle is concerned. And I think that any time that you come in and ask NASA to do anything for you that requires an additional cost on their part to perform that service, then they should be compensated for that.

What I was referring to primarily was the tremendous amount of information that is already at NASA, and the potential in any facility that is just sitting there and not being used and that would go to waste if we didn't use it. I think that would be where I would say that it would be to the advantage of NASA to have that facility used rather than just sitting there vacant.

But any cost incurred as a result of asking for that information I think should be compensated for, sir.

Mr. **Chandler**. I have no more questions.

Mr. **Andrews**. Mr. Hannah, thank you very much for appearing this morning.

Mr. **Hannah**. Well, thank you. I certainly appreciate your support that we have gotten in the past. And I would like to say again how helpful the administration and the Government and the different agencies have been to us. We appreciate it very much, sir.

Mr. **Volkmer**. Mr. Chairman, may I ask one quick question?

Mr. **Andrews**. Sure.

Mr. **Volkmer**. Is it 1985 for your next shot?

Mr. **Hannah**. Yes, sir.

Mr. **Volkmer**. And I remember in your statement you say you are already starting the process of licensing?

Mr. **Hannah**. Yes, sir.

Mr. **Volkmer**. Do you envision that you will be able to do it at less cost this next time?

Mr. **Hannah**. We are getting our full orbital vehicle, so it is going to cost us more than our last one.

Mr. **Volkmer**. No, I mean the licensing process itself.

Mr. **Hannah**. Oh, the licensing process? I think we are going to be involved in more detail here because we are going into an orbital vehicle.

Mr. **Volkmer**. All right.

Mr. **Hannah**. So I think it will probably cost us as much, and maybe a little bit more than last time. But we do have the experience of having done it before, so there will be a saving from that standpoint.

Mr. **Andrews**. Our next witness is Charles A. Ordahl, director of Space Programs at McDonnell Douglas Astronautics.

Mr. Ordahl, thank you for appearing this morning before our committee. We have gotten copies of your statement today. Please feel free to read that statement into the record if you desire, or to summarize it.

STATEMENT OF CHARLES A. ORDAHL, DIRECTOR OF SPACE PROGRAMS, McDONNELL DOUGLAS ASTRONAUTICS

Mr. **Ordahl**. OK.

Mr. Chairman, members of the subcommittee, I would like to thank you for this opportunity to represent McDonnell Douglas in providing you with information on our past and our current space launch vehicle commercialization activities and to share with you some of our views related to the Government's roles and interfaces in these and future space commercial activities and ventures.

McDonnell Douglas has been involved for more than 20 years in providing space launch vehicles and services for NASA and the communications satellite industry as first prime contractor on the Delta launch vehicle and, second, through our payload assist modules, which are upper stages designed to fly on either the space shuttle or the Delta.

For the past 10 years we have undertaken several commercial launch vehicle ventures which have involved the commitment of well over $100 million in development expenditures. In addition, over the last 6 years we have been working on a commercial project called the Electrophoresis Operations in Space involving the separation and purification of materials in space. I believe that Mr. Yardley and Mr. Rose discussed details of that project with the subcommittee in February. These projects have involved highly interactive activities between the industry and Government within the structure of agreements between the parties involved.

Our first such commercial project, undertaken in 1973, was a performance upgrade of the Delta called the 3914, which increased the Delta payload capability to 2,000 pounds into the geosynchronous transfer orbit. At that time, NASA policy was that no further Government funds would be used to improve the performance of expendable launch vehicles in view of the Nation's commitment to develop the space shuttle. However, the emerging domestic communications satellite industry was very interested in the cost effectiveness of the additional Delta launch capability and this thereby set the stage for our first commercial space venture. RCA became the first customer and agreements were structured between RCA, McDonnell Douglas, and NASA to operate the projects as follows:

McDonnell Douglas agreed to design and develop the uprated vehicle at their own risk on commercial funds but with profit limitations.

McDonnell Douglas agreed to recover its investment through a specified "not to exceed" customer charge for each commercial launch; however, there would be no "investment charge" for U.S. Government use of the vehicle.

NASA agreed to contract for production and launch services of the improved vehicle as an integral part of the ongoing Delta program and would provide technical monitoring.

RCA agreed to contract with NASA for three vehicles and launch services and with McDonnell Douglas for three user development amortization payments.

The first launch was successful in 1975 and as of May 4, 1983 there have been 23 launches of which 7 have been U.S. Government missions with the remainder being commercial and foreign customers.

Our second commercial venture in this field was the payload assist module—PAM-D—undertaken in 1976. PAM-D is an upper stage vehicle for Delta class satellites designed to assist launch vehicle customers in planning launches in the era of transition between expendable launch vehicles and the space shuttle. The PAM is basically a part of the payload cargo element and as such it may be used either as a third stage on the Delta or as an upper stage on shuttle to carry the satellite into the geosynchronous transfer orbit. This provides the customer with the flexibility to plan a launch on Delta or shuttle and a relatively easy means to shift between the two if conditions should so warrant. Again, McDonnell Douglas began this development after reaching an agreement with NASA on how the program would be performed. The primary features of this agreement were:

McDonnell Douglas agreed to develop the system completely on commercial funds on a schedule compatible with the shuttle operational requirements.

McDonnell Douglas agreed to sell PAM commercially at a specified "not-to-exceed" ceiling price along with a fixed escalation for inflationary factors in addition to profit limitations.

NASA agreed not to fund or formally solicit the development of competitive or alternate systems.

NASA agreed to provide suitable building facilities at Kennedy Space Flight Center for PAM processing activities with reimbursement as a part of the shuttle launch service contract with each customer using PAM.

NASA agreed to provide interface data and technically monitor the project.

The first commercial PAM contract was signed between Hughes and McDonnell Douglas in 1978. The first flight was successful for Satellite Business Systems on Delta in November 1980. The first two flights on shuttle were successfully completed in November 1982. To date, McDonnell Douglas has contracted 29 PAM-D missions of which all ten have been successfully flown. Sales of PAM are, of course, highly interlocked with the availability and pricing of shuttle and Delta for commercial launches. To date, this has been generally favorable although several potential missions were lost to Ariane in the 1984-85 time period because NASA was not able to offer STS launches at the time these contracts were decided and Delta prices were not competitive. Subsequently, STS launch space is available in those particular years.

In 1977 McDonnell Douglas signed a similar agreement to develop a larger PAM for shuttle launch only called PAM-A. This version has comparable payload capability to the Atlas Centaur ELV. After a competition with another aerospace firm, NASA awarded McDonnell Douglas a firm fixed price contract for 6 PAM-A launches which has subsequently been increased to eight. There are, however, no currently assigned missions for PAM-A and no commercial sales have been achieved.

In 1982 customers began requesting additional performance from the PAM-D system, but short of the more expensive PAM-A capability. As a result, McDonnell Douglas decided to commercially undertake a growth version called PAM-DII, which includes a new motor and raises the payload capability to approximately 4100 pounds into the geosynchronous transfer orbit. PAM-DII retains a vertical shuttle bay installation in order to optimize the overall space transportation price and will be available for launches in

1985. Our initial commercial contract for PAM-DII was authorized in August 1982 with an order from the GTE Satellite Corp. At present, we are negotiating a formal agreement for NASA's technical monitoring of the PAM-DII program.

In general, we consider these commercial launch vehicle ventures to be successful although financial returns have been more difficult to achieve than originally planned, primarily due to schedule delays and increased complexity of the projects. Both the 3914 and PAM programs have experienced invesment/development costs substantially in excess of initial estimates which were the basis for ceiling prices in the agreements and as a result investment return has taken far longer than planned. As a lesson learned, the most unwieldy part of the PAM agreement has been the ceiling price limitation set in 1976 which had, in our opinion, inadequate provisions for timely adjustment to recognize increases in system complexity, technical direction, and schedule delay impacts associated with the developing shuttle system and requirements. In the future, we will have technical working agreements with NASA while allowing the price to be governed by the substantial competitive environment that is developing in the communications industry, thereby obviating any further need for Government price controls.

Overall, our relations with NASA have been excellent in working toward our objectives since these projects have been so closely interrelated with NASA's Delta and shuttle programs. Some learning on both sides has been experienced on the PAM-D program in determining the extent of NASA's technical direction since no Government investment was involved. Although the cost burden has remained completely on McDonnell Douglas, each technical issue arising to date has been ultimately resolved.

In our commercial projects we have been careful not to compete with NASA but rather to be compatible with and companion to their efforts. This was a prime objective of our PAM-D agreement. We are fully willing to compete with any other commercial firm but not directly with NASA. In general, where other business factors are favorable, commercialization can be encouraged through agreement by the Government not to compete with industry in selected areas. We believe this is especially significant in space launch services where the Government has such a dominant position.

Space commercialization can also be encouraged by the Government through favorable and stable allocation and pricing of Government facilities and resources where such are used by commercial projects. Decisions by the Government in these areas will be a substantial and increasing factor as the size and scope of space commercialization projects expand. In fact, in some cases it may well be a deciding factor in whether or not a commercial project is undertaken. So far in this area we have experienced excellent cooperation from NASA for the commercial ventures that I have discussed.

In summary, we at McDonnell Douglas consider these commercial ventures to be successful thus far and look forward to continued cooperation with the government in improving our interactive relations and in expanding our efforts in areas of mutual benefit, thereby improving our Nation's overall space capabilities.

This concludes my prepared remarks.

Mr. ANDREWS. Over the past many years our country has established this huge infrastructure of scientific space knowledge and technology. And I wonder if you would comment on how we go about assessing some value to be placed on that knowledge and that technology.

Mr. ORDAHL. Well, It is pretty difficult to establish an overall value for it. I believe that for the purpose of particular ventures that there is an application of specific resources and facilities that one can tangibly evalute. And from that point, one can establish the initial values, the residual values or possibly, the continuing values of parts of that investment for a particular application or venture.

I would find it difficult to determine, assess and account for the learning and experience of 25 years or more of developments in space.

Mr. ANDREWS. I guess the point is how do we insure adequate and fair competition between private companies that compete for this technology. What steps do you think should be taken by Congress to assure that competition will be fair?

Mr. ORDAHL. Well, certainly where Government participation is involved to some degree, again, either through use of Government facilities or Government expertise in some fashion, that there needs to be a stated policy that is uniform and applied, insofar as possible, to all the comers.

As an example, NASA's shuttle pricing policy establishes a uniform price structure so that all shuttle customers will know value and can assess it in their business plans.

I think uniformity and stability, is important so that competing concerns can decide on the same basis to either use an avilable Government resource or decide to go elsewhere.

Mr. ANDREWS. How do we avoid establishing a monopoly? How do you keep that from happening in the transfer of our assets?

Mr. ORDAHL. Well, I guess in the case of the expendable launch vehicles, if that is an area that we are considering here, there are several expendable launch vehicles that are currently available in the inventory. They are all highly developed and reliable vehicles. They have different payload performance capabilities and other attributes that will be considered in a competitive sense and ultimatly the best one will win the largest market share.

Now, I believe there is presently the basis of a competitive environment that doesn't require much additional Government attention to make it function other than to provide the policy by which these particular systems, which were originally developed on Government funds, are to be transferred to the commercial sector.

Certainly the pricing of Gvoernment facilities, the range, or safety requirements, would all have to be uniform. But the companies are there and they can compete in the normal business environment.

Mr. ANDREWS. Thank you.

Mr. Brown?

Mr. BROWN. I have no questions.

Mr. **Andrews**. Mr. Chandler?

Mr. **Chandler**. Just a quick followup to the question that you raised, which I think is a very interesting one.

From my perspective there in the State of Washington, your company represents one of the major competitors with Boeing, in the commercial airplane business. It struck me as the chairman asked the question about how to avoid lack of competition. Given the size necessary to venture even into the commercial airplane business, you have an even narrower market here. How can you have a competitive business, whether it is in ELVs or whatever, as we move into this commercialization? Is it realistic not to have monopolies, coming at it from the other side than from the chairman?

Mr. **Ordahl**. I am glad you brought it up that way, sir, because that is a concern.

I have studied the Delta class launch vehicle market, and, quite frankly, I don't subscribe to huge increase in launch vehicle demand that some people have predicted. I think that is growing, however, certainly not following an exponential curve.

I consider a Delta class requirement as a satellite that can be launched by the Delta ELV or by PAM-D or PAM-DII on a shuttle.

Now, my crystal ball says that for the foreseeable future there may be 10 to 12 of this class missions up for launch competition each year, not counting, military applications or European missions that are locked into Ariane.

Now, there is always the question of how many of these can the shuttle carry. For this particular class of payloads an individual shuttle flight can carry four. NASA probably wouldn't put four on very many shuttle flights since it is a good mixer with other type payloads. Looking at the future STS manifest you can see that NASA flys PAM's on many of their flights.

My analysis indicates the shuttle can easily carry 10 to 12 of these class satellites when the STS program is fully operational. So it worries me in a competitive sense for the ELV's to compete both between themselves and also with the shuttle.

I think that the market for this particular class is fairly small to start dividing up very much. And so one does have to worry about how much competition there will be, if the shuttle is carrying a very substantial portion of the market.

I think that is a condition of the situation that we face here. I don't know, really, how to solve that.

Mr. **Andrews**. Mr. MacKay?

Mr. **MacKay**. Thank you, Mr. Chairman.

I am not sure I fully understand the terms of your agreement with NASA. When you signed the initial NASA agreement, it is almost in the nature of a joint venture agreement in which they agree not to compete. In other words, not to parallel or duplicate your effort to design this particular technology. Do they also agree not to work with any other contractor? In other words, they don't put two of you to work on the same project?

Mr. **Ordahl**. Our concern was that we did not want to compete with a Government-funded program. That is, another company operating on Government funds doing the same job on contract to NASA. The agreement does not in any way preclude other companies from doing exactly the same thing that we are doing in the case of PAM, or this particular class of ventures.

In fact, NASA put out announcements to industry stating that this was being done, and that anyone else who was interested could do the same thing. But our main concern was that we didn't want to compete with the Government.

Mr. MacKay. Did they guarantee you enough of a market so that you could foresee recovery of the initial investment?

Mr. Ordahl. In the case of the PAM-D program, which was the program in which there was the largest market, there was no guarantee whatsoever in terms of the market size. We simply agreed to undertake the venture and to provide the system, and whether there was one or 20 or 50 of these sold was our particular risk.

Now the ceiling price that I mentioned earlier was included in the agreement to satisfy NASA's concern that the overall cost of launching on the shuttle using the PAM be low enough. We agreed to this ceiling price on the basis of a planned amortization quantity. Now, there were no guarantees, but we did select a quantity of vehicles that we thought would be reasonable to amortize the nonrecurring costs over, and that structured with the recurring costs for each launch constituted an agreed ceiling price.

We had to then predict two things, one being the amount of investment cost that we would have to undertake, and two, the size of that market.

How, that was the PAM-D. In the case of the PAM-A we really did not as a company prefer to go into the PAM-A program, however NASA wanted a PAM-A because it was compatible with the Atlas Centuar class satellites. They solicited industry to develop PAM-A on a similar basis to the PAM-D.

In studying the market for the PAM-A class we were not at all convinced that it was a good thing to commercially undertake at that time, especially since it required a horizontal installation in the shuttle bay which was, by virtue of the shuttle pricing, not very competitive.

However, NASA then stated that they would negotiate a contract for six vehicles that would be on a firm fixed-price basis, and for which there would be a competition throughout industry. But they wanted the project done on commercial funds as a commercial endeavor, although they would contract for a specific number of vehicles. This purchase, in itself, did not fully pay back the nonrecurring investment, but paid a big share of it.

We finally decided that since we were in this business that we would undertake the project with those conditions. We did compete with another firm that also was making that same decision at the time. Ultimately we were selected.

So we got into the PAM-A, which hasn't turned out very well. We tried to market it commercially, but thus far we haven't sold any others than the original NASA ORDER. The NASA order is currently eight vehicles since they exercised an option in the contract for two additional systems.

Mr. MacKay. So the risk, then, that you take is you get a part of your development costs sort of guaranteed or underwritten by NASA. Your risk is you have got to go out and try to identify a market in order for the overall project to be profitable to you.

Do you end up with exclusive, proprietary rights in whatever technology is developed?

Mr. ORDAHL. Yes. As I said, in the case of the PAM-D and the PAM-DII we have no government sales for government missions whatsoever. There are no Government funds flowing into either of those programs at this time. In the case of the PAM-A, it was as I described. In both cases we have the rights, basically, to the investment, the system, if you will. In the case of the PAM-A, of course, the hardware that the government buys is theirs.

Now, there are many provisions in these agreements that should we drop out of the business for any reason, that we must turn over these rights under certain stated conditions to NASA so that they could, if necessary, fulfill their objectives on a longer-term basis. We have no interest in doing that, of course, but that is in the agreement.

Mr. MACKAY. So all you got in the first PAM, the PAM-D, was almost like a hold-harmless. They would not fund somebody else doing the same thing, but you didn't get any guarantee that they would purchase any of these?

Mr. ORDAHL. In the 29 PAM-D sales to date, none of them have been procured for U.S. Government use or on U.S. Government funds.

Mr. MACKAY. Thank you, Mr. Chairman.

Mr. ANDREWS. Mr. Nelson?

Mr. NELSON. Just following that last statement, maybe we should have purchased PAM-DII to get the TDRSS up into its proper orbit.

Would a PAM-DII carry a load as big as a TDRSS?

Mr. ORDAHL. No.

Mr. NELSON. A TDRSS is how heavy?

Mr. ORDAHL. Well, the TDRSS, is about 5,000 pounds, in final geosynchronous orbit. So it must be about 10,000 pounds in the transfer orbit. A PAM-DII can carry about 4,100 pounds to the transfer orbit therefore it has less than half of the capability required for TDRSS.

Mr. NELSON. So you are just developing that payload assist module for commercial satellites?

Mr. ORDAHL. Well, it is for a certain class of satellites, most of which have been commercial, yes. We would use it for military or NASA Government missions if there were some in this class that needed it. But so far, they have not used it. At least NASA has not.

Mr. NELSON. Okay; let me ask you about one of your statements here. Several potential missions were lost to Ariane in 1984-85 time period, because NASA was not able to offer STS launches at the time. Do you want to give me some background on that?

Mr. ORDAHL. Well, at that time these contracts were decided which I suppose must be almost a couple of years ago, the shuttle manifests were full in 1984 and 1985. They had U.S. Government missions, commercial missions, DOD missions. If you looked at the flights that they had planned in that period, they were completely full.

So when these competitions came along, the candidates were the Delta, the Ariane and the shuttle. But on the manifest planning data NASA didn't have space on shuttle. So they couldn't offer a shuttle.

The shuttle price in 1984 is by far lower than an Ariane offered. So had we been able to offer shuttle space I am quite sure that we would have kept those missions.

Now, by the same token, the Delta at that point in time was priced well above what the French were willing to offer the same launch service on the Ariane. So those particular customers evaluated the conditions and decided that they were willing to go with Ariane for the substantially lower price than they would have to pay for a Delta launch. Since the price was many million of dollars less per launch it was sufficient to convince them to move to a newer, less tried vehicle.

Subsequently, there have been adjustments in the shuttle manifest. Some of the DOD, NASA and commercial missions that were on paper at that time in the shuttle manifest have simply moved out in time. Now in the current 1984 and 1985 shuttle manifest there is perhaps 20 percent of the launch space available. It was not available at the time these particular contracts were let.

So therein is a part of the problem. The reality is that when a payload customer gets to that time where he must start paying substantial sums of money for his shuttle launch it is a time of truth and some will simply move out to the later time. So there is always this balancing that must go on in the marketing versus the reality.

Mr. NELSON. Earlier this year, Mr. Yardley of your company testified that he was concerned for materials processing in the future. He made a statement to the effect that private enterprise would not commit the dollars for up-front investment if they were not guaranteed that they had space aboard the shuttle at some future date in materials processing.

I think that statement was made in February. Has anything changed your mind as to the uncertainties of availability of the shuttle over the course of the last 2 or 3 months?

Mr. ORDAHL. Well, no. I think that we still have concerns on the longer term than the commitment be there. I believe Mr. Yardley has said we as a company have fairly close associations with NASA and have some reasonably good understandings of what goes on in the shuttle program, and can make some reasonable guesses about what might happen operationally or technically.

We can't foresee for sure what might happen in the areas of pricing policies and commitments of the availability of the shuttle for the commercial operator. And I don't think that anything has particularly happened to change our opinion. We are still looking for a Government policy that basically would make the commitment of the availability of shuttle flights. If industry needs the shuttle flight, the resource would be provided, because, as Mr. Yardley indicated, no single company is going to be able to commercially build a shuttle that can go back and forth in space.

Mr. NELSON. Would your concerns be lessened if we made a commitment to a fifth orbiter?

Mr. ORDAHL. I am sure that a fifth orbiter would provide a degree of flexibility that is not in the system at the present time. If NASA should have trouble with an orbiter and it is down for a long time, the fifth orbiter would help sustain the planned operational schedule.

Considering the current STS manifest, on the near term I can't honestly say we must have a fifth orbiter. But it certainly would be more gratifying in that it would provide a degree of assurance for the system that is not there without it.

Mr. NELSON. Would that assurance be heightened, also, if we made a commitment to go with a space station?

Mr. ORDAHL. Well, very clearly, I feel that we need a space station. If we really want things like this electrophoresis operation in space and projects of that nature to really move forward on a more aggressive basis, we need something like a space station that will allow this to happen.

The shuttle would be a more useful machine, also, if we had a space station. It was to be one part of the overall system. It is really designed for men in orbit, for carrying cargo back and forth to space stations and that is really what it should be used for. We are using it, of course, to a large extent, as a replacement for the ELV's. It is not, in my opinion, the best system for that purpose but is being used in this way primarily because it is available.

But ultimately we need that space station, which will also allow us to make better use of the shuttle.

Mr. NELSON. Mr. Yardley testified in February that particle separation in your electrophoresis could bring about the solution to such diseases as diabetes, dwarfism, thrombosis, and he mentioned one more that I can't remember. Do you have any indication in your collaboration with Johnson & Johnson that particle separation would be helpful in cancer research as well?

Mr. ORDAHL. Mr. Nelson, that is getting out of my field. I am not directly involved with the electrophoresis project.

Mr. NELSON. Would you ask somebody in your organization to respond to that?

Mr. ORDAHL. We could certainly check on that for you, and give you that information.

[The information follows:]

We are currently investigating how the cell separation capability of our electrophoresis technology might be applied to several promising materials which may have application in the treatment of specific cancers.

Mr. NELSON. Thank you, Mr. Chairman.

Mr. ANDREWS. I noticed on the third page of your statement you mention that you are presently negotiating a formal agreement for NASA's technical monitoring of the PAM-DII program.

Mr. ORDAHL. Yes.

Mr. ANDREWS. I wonder if you would comment on the major characteristics of a monitoring agreement. What, in your opinion, should it include in terms of inspections, quality control, and data that might be required to satisfy any Government oversight procedures.

Mr. ORDAHL. This is an area that we have been going through a period of development with NASA over a period of time. Our experience is primarily on the PAM-D program.

Basically we have felt that NASA needs a full oversight responsibility to assure that the system is designed to properly integrate into the shuttle, that it meets all the requirements that they specify in their documentation for that process; that it meets all the safety requirements; that it can be properly deployed by the astronuats.

The areas where we get into some questions are how far NASA should go into evaluating the reliability of the product itself. Once it leaves the shuttle it is on its own; a commercial product bought and paid for by industry. But NASA wonders about its responsibility to have checked on the components that went into the box or looked at the acceptance data on the motor and so forth. It is in this area of quality assurance and reliability that we have felt that we don't particularly need NASA oversight.

I think for the most part we have arrived at agreements that have been satisfactory after some amount of discussions in those areas.

Mr. **Andrews**. Does anyone have any other questions?

[No response.]

Thank you very much, Mr. Ordahl.

Our next witness is Bruce W. Ferguson, vice president and general counsel, Orbital Systems Corp.

Good morning, Mr. Ferguson.

Mr. **Ferguson**. Good morning, Mr. Chairman.

Mr. **Andrews**. We have copies of your statement that have been handed to us this morning. You are invited to read that statement or you may summarize it for the committee.

STATEMENT OF BRUCE W. FERGUSON, VICE PRESIDENT AND GENERAL COUNSEL, ORBITAL SYSTEMS CORP.

Mr. **Ferguson**. Thank you.

I am happy to appear before this committee this morning to present OSC's views on cooperative arrangements for the commercialization of space. OSC currently has agreements with both NASA and Martin Marietta Corp. to develop a high-capacity upper stage for use on NASA's space shuttle.

This upper stage, called the transfer orbit stage, or TOS, is a large, single stage solid-propellant rocket that is carried up with its payload in the space shuttle to low earth orbit. The TOS and its payload are then launched by the space shuttle to transport communications satellites and other payloads from the low earth orbit of the space shuttle—approximately 160 miles above the Earth—to higher orbits that the heavy space shuttle cannot reach, such as the geosynchronous orbit utilized by most communications satellites—approximately 22,300 miles above the Earth.

The evolution of the commercial satellite market to larger, heavier satellites indicates that an economical high-capacity upper stage such as TOS is well positioned to capitalize on a significant business opportunity. Current launch systems, such as the PAM-D upper stage used on the space shuttle, which was described by Mr. Ordahl, are economical only for smaller satellites. At present, there exists no economical way to launch large satellites of the TOS class—approximately 2,800 to 6,800 pounds—into geosynchronous orbit, other high orbits, or on planetary missions. A sophisticated two-stage rocket, the inertial upper stage, developed by the Air

Force primarily for military use in the space shuttle, is very expensive, has reliability problems, and has a lower payload capability than the TOS. The only publicly announced program to develop an economical launch capability for TOS-class payloads, in fact, is the European Ariane rocket program that competes directly with the space shuttle. NASA must provide a similar capability in order to remain competitive with Ariane for commercial payloads.

Recognizing the need for an economical, high-capacity upper stage for use on the space shuttle, NASA signed a preliminary agreement with OSC on December 17, 1982, providing for further discussions of OSC's proposal to finance, develop, market and operate the TOS. Based on these discussions, on January 24, 1983, NASA ceased its own efforts to develop a TOS-class upper stage and a few months later, on April 18, 1983, NASA signed a final agreement with OSC to develop the TOS.

Under the terms of the agreement, OSC will develop the TOS using private funds at no charge to NASA, and NASA will provide technical monitoring out of its Marshall Space Flight Center in Huntsville, Ala. to insure that the safety requirements of the space shuttle are met. NASA also agrees to provide certain interface data on the space shuttle and related facilities. No subsidies or purchase guarantees are involved.

To provide technical and manufacturing capabilities necessary for success of the TOS program, OSC held discussions with a number of large aerospace companies in late 1982 and early 1983. From these companies, OSC chose Martin Marietta Corp. to act as OSC's prime contractor in developing and manufacturing the TOS. Martin Marietta signed a preliminary agreement with OSC on January 21, 1983 and is now working with OSC under a contract dated as of April 1, 1983.

Under the terms of the contract, Martin Marietta's Denver Aerospace Division serves as prime contractor to OSC for the TOS program, performing most of the design, development, testing, and production of the TOS hardware and managing TOS subcontractors. For its part, OSC will have primary responsibility for financing and marketing the TOS. The first TOS is expected to be available for launch by the fall of 1986.

OSC believes that its rapid progress to date in the space commercialization area is without recent parallel. This progress can be attributed to several factors. The most important of these is the business feasibility of the project—the emergence of a well-defined commercial market for the TOS in the next 3 to 5 years, combined with relatively low required investment. The business feasibility of the project has enabled OSC to obtain private financing rather than grants or subsidies that take longer to arrange.

Another key factor is the acceptability of the project to NASA. The TOS is a new system that will promote the commercial use of the space shuttle, allowing NASA to leverage its budget with private funding in the pursuit of its goals. Rather than take existing operations away from NASA or compete with NASA, OSC with the TOS program alines its interests with those of NASA. OSC's status as a small business concern underscores the total commitment of OSC and its employees to the success of the TOS program. We have further suspected that, knowing what a demanding project the TOS program is likely to be, NASA also regarded the relative youth and excellent health of the company's founders as an asset.

OSC has received the full support of NASA's top officers in its efforts to establish the TOS program. It is our impression that these individuals, who include James Beggs, General Abrahamson, Messrs. Culbertson, Allnutt, Hosenball and Phillips, as well as Joe Mahon, Jack Wild and B.C. Lam in the Special Programs Division and Gene Austin in the Marshall Space Flight Center, firmly believe in the desirability of private investment in space and are actively involved in identifying and supporting feasible private initiatives in the space commercialization area. Because of the dominant role that NASA plays in space activity, such support is a vital prerequisite to future progress in space commercialization. OSC has also received cooperation from Martin Marietta Corp. that extends significantly beyond contract requirements and indicates the personal commitment of Martin Marietta's management, including Norm Augustine, Peter Teets, and Richard Farrell, to making a success of our innovative teaming arrangement. The marriage of the entrepreneurial energy of a small firm with the technical and production resources of a large aerospace company has been important to the progress of the TOS program and might serve as a precedent in future private endeavors in space.

I would also like to acknowledge the efforts of the McDonnell Douglas Corp. in negotiating and implementing the PAM program, which has been of significant precedential value to us in our efforts. The similarity of the programs—they both involved upper stages—meant that many NASA individuals were already accustomed to the idea of the private development of an upper stage. I am sure that that negotiation was a difficult process, and I wish to acknowledge that it did have some benefit to the commercialization area above and beyond the benefit to McDonnell Douglas.

Space commercialization needs some early success stories. The public—including the financial community—is somewhat in awe of the technical and operational complexity of the space program, and correspondingly skeptical of the efforts to commercialize space activities.

I would say, Mr. Chairman, that the investors we find least skeptical are located in your district. Houston, I think, is accustomed to the idea of taking risks, and some of our investors are in fact oil men who are most susceptible to this kind of project.

To the extent that NASA and this committee support projects with a high likelihood of success in a few years, public perception of space commercialization as a new sunrise industry will inevitably increase the number of high quality projects and available private investment. Cooperative arrangements between NASA and private firms, we have found, are an effective means of demonstrating NASA's support for such projects, and should continue to be implemented where practicable.

I think it is very appropriate that these hearings are held on the 25th anniversary of NASA's formation. Then, as now, the United States faces a major challenge in the space area. Back then it was in the military arena. Now it is in the commercial area. We are trying to do our part to provide part of an effective response to that challenge.

Mr. Chairman, that concludes my prepared statement. I would be happy to respond to any questions.

Mr. ANDREWS. Mr. Ferguson, relative to the joint endeavor agreement as a contractual instrument, I wonder if you would care to comment, please, on NASA's ability to monitor quality control.

Mr. FERGUSON. I would first like to distinguish between our agreement, which is based on the PAM agreement, and provides for no NASA assistance in the form of shuttle space, from another McDonnell Douglas agreement in electrophoresis, which is what is normally called the joint endeavor agreement.

The joint endeavor agreement as it is structured provides for some shuttle space in the very early research and development stages of the project. To address your question directly, we think that in our agreement and in the joint endeavor agreement there is a great deal of—well, there are a number of interesting things that can be said.

Our agreement provides that NASA will not compete in the funding of a similar program. It provides that NASA will look at certain documents that we provide to them. These documents do not go to the reliability of the system; at least NASA has no ability to direct us to change our reliability goals. NASA has agreed to those goals up front.

As Mr. Ordahl indicated, NASA has very strict controls over safety, and is obviously concerned that whatever is sent up—especially a rocket such as the TOS or the PAM-D, be very safe so that the astronauts and other payloads won't be endangered.

Right now we have agreed to provide NASA with a very extensive set of documentation which not only applies expressly to the safety issue, but also to the rest of the reliability questions. They don't have actual direction capability other than in the safety area.

Mr. ANDREWS. Mr. Brown?

Mr. BROWN. Mr. Ferguson, do I understand that the TOS program does not compete directly with the PAM program?

Mr. FERGUSON. That's correct.

Mr. BROWN. The weight classifications are completely separate so that you are not involved in——

Mr. FERGUSON. Yes, sir.

Mr. BROWN. In other words, you have two separate markets in effect?

Mr. FERGUSON. That's correct, sir. Our perception has been that the commercial satellite market has evolved toward larger and larger satellites. If you look at the first communications satellites launched in 1965 and compare those to the average launched in 1980, there has been a 26-times increase in weight during that 15-year period.

Accordingly, just extrapolating a bit, we very quickly grow beyond the PAM capabilities into the TOS-class capability. And there is no direct competition in those markets. They are different rockets.

Mr. BROWN. Have you tried to extrapolate even further down the line and see how those markets are changing and how long TOS will be able to meet the needs for the evolving communication satellite technology?

Mr. FERGUSON. Yes, sir. We have looked at future needs and feel that eventually the satellite market will grow beyond our capability into something like the shuttle Centaur, which, as you know, is now being developed by the Air Force and NASA for some planetary missions and military missions.

We don't expect that evolution to take place much before the early 1990's, and accordingly see a very good market window, which is about all that a commercial business can ask.

Mr. BROWN. Now, you made some remark here about the relative youth and excellent health of the company's founders. Can you tell me a little bit more about the company's founders than that, that they are young and healthy?

Mr. FERGUSON. Yes, sir.

The founders met in the course of performing a study for NASA, at the Harvard Business School. The study looked at commercialization efforts in the materials processing area. NASA was interested in how it could best market its capabilities in that area.

We made a series of recommendations to NASA, some of which were followed and some of which weren't. But in the course of that project we realized that we enjoyed working with each other, that this area was important to us—the general commercialization area—and that accordingly we should look for different opportunities in the commercialization area.

We undertook a review process during the next year and a half, investigating a wide range of possibilities. During that time we centered on the idea of a new upper stage that would fill the gap between the Centaur and the PAM series.

The backgrounds of the officers—our president, David Thompson, is a former NASA employee. He has worked at a variety of aerospace companies and at the Rand Corp. He has both his bachelors degree and a masters degree in aeronautical engineering. His bachelors is from MIT and his masters degree is from Cal-Tech.

Our marketing director, Scott Webster, has a mechanical engineering degree and worked at Litton Industries as a senior engineer when the microwave project was starting up, and then went to Advanced Technology Laboratories in Washington State, where he was in charge of marketing a very highly advanced form of medical scanner.

These two individuals, and myself, were the founders. We have a variety of other employees who have since come on board, but that was the core group when the company started up.

Mr. BROWN. Now, tell me why it is that a small group like this, presumably with modest amounts of capital available, are able to succeed in a commercial opportunity like this rather than one of the large aerospace firms that you are working with anyway. It seems to me that Martin Marietta or one of the other firms could just as easily have undertaken this project as an internal operation.

I am interested in why this happened the way it did instead of some other way.

Mr. FERGUSON. Well, the capital we found available in Houston is anything but modest, and I have heard that is characteristic of the Texas lifestyle.

We have been able to compete, I think, because we are in large part a small company. Back in the fall—it is an interesting story—NASA made the rounds of the major aerospace companies and said, "why don't we develop a new upper stage as a commercial vehicle," following on the McDonnell Douglas precedent. The aerospace community knew that NASA wanted a vehicle like this for certain Government missions that would be needed in the 1987 time period. The companies accordingly thought this would be a Government program, with normal contractual obligations and so forth, funded by the Government.

So the answer NASA received was "No thanks, it is a Government program; you fund it." We, however, saw that there was a significant commercial opportunity in this vehicle, above and beyond the Government sales. And we went to NASA with a proposal to develop it commercially.

On January 24 we were able to present enough information to NASA showing our teaming with Martin Marietta, our financing, and our management capability, that NASA said "All right, we think you have got a good shot at being able to carry this off; it is no longer a Government program."

At that time NASA issued a notice in Commerce Business Daily asking whether anybody else was interested. There were three responses at that time from large aerospace companies, but we, as a small company, were able to move very quickly and successfully negotiated an agreement in April.

NASA, under its statute, is obligated to equitably apportion agreements with small companies, and I think that worked to our advantage as well.

At this time other aerospace companies are still interested in an upper stage like this. There is some question whether the market is big enough for two or three vendors for a stage like the TOS in addition to the competition represented by Ariane. It is an international market. But that underlies the reason why we were able to move so quickly. It is, I think, a lot harder for a large corporation to make a decision from January 24 to April than it is for a small company.

Mr. Brown. That is a rather interesting history, because as you probably know, this committee has been encouraging NASA to provide opportunities for small companies for a number of years. And it is heartening to see a success story arise from that concern.

Mr. Ferguson. Sir, I would like to underline the fact that both this Congress and this administration and prior administrations have uniformly been in favor of commercializing the space area. This House, as you note, has particularly been interested in helping small business.

I think that the nonpartisan support for this concept is very much in place in NASA. Every NASA individual with whom we have worked closely has been very deeply committed to the idea of spinning off space technology to the private sector.

Mr. Brown. Thank you very much, Mr. Ferguson. I have no further questions.

Mr. Andrews. Mr. Volkmer.

Mr. **Volkmer**. I just have a couple of questions. I remember reading your statement last night, and it was very interesting. But do you, as yet, have any customers for your vehicle?

Mr. **Ferguson**. We are now negotiating for the first customer's launch, which would be in the fall of 1986. And, as I have indicated, NASA needs to use something like our vehicle—either our vehicle or Ariane—to launch the MSAT, which is a joint Canadian/United States satellite in 1987. Unlike many of the other space commercialization areas, we do have a very well identified market, and in fact in our discussions with commercial satellite manufacturers, all of the large manufacturers are either now designing or are planning to design satellites in our weight class.

Mr. **Volkmer**. In other words, you anticipate that communications satellites will exceed the 3,000 pounds?

Mr. **Ferguson**. Yes, sir. There are good reasons for that. Economies of scale in having larger satellites; and the crowding of the geosynchronous orbit means that that real estate is very valuable. And, for the same reason that you get high rises in downtown New York and very large sky scrapers, you tend to get larger satellites in that valuable real estate up in geosynchronous orbit.

Mr. **Volkmer**. I have no further questions. Thank you very much.

Mr. **Andrews**. Mr. MacKay?

Mr. **MacKay**. Mr. Ferguson, I am just fascinated by the process you went through, and I would like you to give me a thumbnail sketch of the nonconfidential aspects of what you said to your investors and what they said back, with the expletives deleted.

Mr. **Ferguson**. We went to Houston late last summer. At that time we didn't have a project; we didn't have an office; we had no understanding with NASA. There were just three individuals. And that is what is known, I think, as a wildcat investment opportunity. The investors recognized it for what it was. But they also saw that as a small company we were well positioned to move very quickly. They believed the fact that there is a market developing out there. And accordingly, they were willing to take the risk.

Negotiating for capital is one experience that far exceeds the trials and tribulations of negotiating with the Government. I would say, however, that our seed capital investors have been very supportive all through this program.

Mr. **Andrews**. It is testimony like this that has caused so many people from Michigan to move down to Houston. [Laughter.]

Thank you very much, Mr. Ferguson.

We have a vote, and this subcommittee will hereby be adjourned until May 17, at 1:30 p.m., in room 2325.

[Whereupon, the hearing was adjourned at 11:38 a.m., to reconvene subject to the call of the Chair.]

SPACE COMMERCIALIZATION

TUESDAY, MAY 17, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, D.C.

The subcommittee met, pursuant to notice, at 1:40 a.m., in room 2325, Rayburn House Office Building, Hon. Harold L. Volkmer (chairman of the Subcommittee on Space Science and Applications) presiding.

Present: Representatives Volkmer, Nelson, Andrews, Mineta, Lujan, Lowery, Bateman, and Walker.

Mr. Volkmer. Good afternoon. The Subcommittee on Space Science and Applications will come to order.

Today, the subcommittee is continuing with a series of hearings on the commercialization of space. The objective of this hearing is to acquire an understanding of the major issues associated with the potential commercialization of space launch vehicles.

The development of the shuttle space transportation system has established a new national resource for scientific, national security, and civil applications. However, the system is new and we may be remiss if we do not maintain a balanced set of alternative launch capabilities into the foreseeable future, especially in light of growing foreign competition.

As it is the stated policy of the administration to phase expendable launch vehicles out of operation over the next several years, this is an appropriate time to study the issues surrounding the operation of the expendable launch vehicles by the private sector.

On January 27, 1983, Congressman Akaka introduced the Space Commerce Act in the House. This bill is designed to provide encouragement and necessary regulation for the commercial development of space, and focuses primarily on ELV commercialization. It is a pleasure, therefore, to welcome Hon. Daniel K. Akaka as our first witness.

Mr. Akaka will be followed by Lt. Gen. James Abrahamson, the Associate Administrator for NASA's Office of Space Flight. Our final witness today is Herbert A. Reynolds, Deputy Director for Intelligence and Space Policy at the Department of Defense.

Gentlemen, we are pleased that you can be with us today, and we'll start with Congressman Akaka.

Your statement will be made a part of the record and you may read your statement or summarize, however you see fit.

STATEMENT OF HON. DANIEL K. AKAKA

Mr. AKAKA. Thank you very much, Mr. Chairman. I want to take this opportunity to thank you for having me share my views on the issue of commercialization of space launch systems.

As you know, I have some very definite opinions on that subject which I'm delighted to share today. The importance of this issue, Mr. Chairman, to the long-term future of our Nation's space effort cannot be overstated. The decisions we make today will surely determine the shape of our future.

If we fail to make these decisions in good faith, and with the courage and foresight required to guarantee success, we have only ourselves to blame. There can be no doubt that a national policy decision to commercialize space launch systems is an action which carries with it a certain amount of risk.

In the case of the commercialization of expendable launch vehicles, for example, there is the risk involved in turning over to the private sector a capability which the Government may need as a backup to the space shuttle. What happens if, at some point in the future, the private sector cannot deliver backup launch services when needed?

Can national security interests continue to be protected if launch systems are commercialized?

Should the Federal Government be willing to take the risk for possible damages to a third party stemming from a failed commercial launch, as it is required to do under the 1967 Outer Space Treaty?

And, finally, there is the important question of the extent to which commercialization of ELV's may take potential payloads away from the Government-developed shuttle.

These are risks that should not be taken lightly.

The private sector has its own risks to weigh. Will there be a real market for commercial ELV's?

Will shuttle-pricing policy change, making it more difficult or impossible for the commercial ELV operators to compete?

Will the Government carry out a commitment to commercialize in good faith; that is, by not arbitrarily raising the costs of operations associated with ELV's—operations such as range safety?

Another critical question is the possibility of DOD usurping commercial payloads capriciously. Any such preemptive action on the part of the Government would certainly disrupt private sector operations.

It is clear that the risks cut both ways. The question is: are these risks worth taking?

The answer is very simple. Just look at the results of failing to take these risks. The brochure before you lists the advantages of using the European launch vehicle Ariane and as used by Arianespace for its marketing activities.

I urge you to take the time to read this document carefully and then tell me: if you wanted to launch a satellite, would you book on Ariane or the shuttle?

The Senior Interagency Group (SIG) has been examining the question of commercialization of launch services for the past few months and finalized its recommendations this past weekend.

I am greatly pleased with its recommendation to proceed with the commercialization of ELV's. I am keenly aware that a mechanism must be found to properly implement this policy.

To this end, I introduced H.R. 1011, the Space Commerce Act, as a logical first step in confronting these issues.

In August 1981, when Space Services, Inc., sought clearances for a suborbital test launch, it was forced to obtain regulatory permission clearances, and approval from five different agencies or bodies: the FAA, the State Department, the FCC, NASA, and NORAD.

Furthermore, because they imported some of their rocket components, they also had to register with the Bureau of Alcohol, Tobacco, and Firearms.

The company also had to register with IRS. As a result of the lack of clear Federal policy and procedures in this area, it took this company over 6 months and a quarter of a million dollars to receive its clearances to launch a test flight.

My bill, H.R. 1011, would designate the Department of Commerce as a lead agency for processing such requests. Four other agencies have been mentioned as possibly playing this role—the Department of Defense, the State Department, FAA, and FCC.

In my opinion, DOD should not be given this responsibility because regulation of the private sector is not one of DOD's mandates and I'm sure DOD has better things to do.

The FCC, while it plays a significant role in issuing licenses for the use of communications frequencies, has limited expertise in other commercial space-related areas.

The FAA, while at first glance a likely candidate, would have no jurisdiction over launches taking place from installations controlled by DOD or outside the continental United States and its primary responsibility is air safety. It has little technical expertise in the field of space launches.

The State Department has neither the regulatory charter nor the technical expertise to assume a lead agency role in regulating commercial space launches.

As a third-party agency, Commerce, is an obvious choice. It has a charter which permits this type of activity and, more importantly, when we talk about space-launching services, we are talking about business—we are talking about commerce and about trade.

In a very real sense, we are creating a new industry in this country and, as such, from a philosophic and policy point of view, this industry belongs under the Department of Commerce.

Although the Department of Commerce has no specific expertise in regulating space launches, neither does any other agency, for this industry is a brandnew one.

I realize that creating a set of policies and procedures for developing and regulating this new industry will not happen overnight. I, therefore, support the creation of a high-level working group to coordinate the development and implementation of these policies and to designate a lead agency and initial point of contact.

I cannot, however, lend my support to the recommendation made by the SIG group yesterday that the Department of State serve as an interim lead agency and initial point of contact.

Of all the agencies, the one most likely to make sure that a proper business and a regulatory climate is never created for private sector activities is the Department of State.

Furthermore, State has neither regulatory charter nor the technical capability to assume a lead-agency role in regulating commercial space launches. Some have even questioned to what extent the Arms Export Control Act should be applied to the launch of rockets and suborbital flights.

Although the State Department does have a significant role to play with regard to adherence to international treaties and agreements, to designate State as the lead agency and initial point of contact for commercial space activity is tantamount to saying that we really don't want to encourage private sector involvement in space launch systems.

Many currently make the claim that the State Department cannot handle the policy responsibilities it already has. I am, and will continue to be, categorically opposed to any move to assign either lead-agency responsibility or initial point of contact responsibility to the Department of State.

I have always made the point that a Bureau of Commercial Space Activities should be created at Commerce, tapping the agencies in which the experts now work (NASA, State, DOD, FCC, and FAA) for its own staff.

This can be done through legislative authorization and reprograming, with little, if any, additional funding. As a Member of the House of Representatives and a Member of the Appropriations Committee, I lend my full support to such a reorganization.

Eventually, this Bureau might even be accorded full agency status, but such an action may be as far as 20 or 30 years away.

The bulk of my testimony today has been about ELV's, but I would like to mention the shuttle as well. I think commercialization of the shuttle is inevitable. The primary question is: When is the right time? Is the shuttle truly operational?

These questions need answers but, for my part, I simply don't know yet. What is clear, however, is that NASA is an R&D agency by design and by statute. In the long term, commercial operations do not belong in NASA, unless we redefine the mission of the agency.

In the meantime, the private sector undoubtedly has a great deal to contribute to the shuttle marketing operation and such proposals deserve serious consideration by this administration and the Congress. We have a great deal of money invested in our shuttle program. According to NASA, the total cost for research, development, tests, and evaluation of the shuttle was $10.1 billion in real-year dollars.

This is a sizable investment and one which we cannot afford to throw away.

The shuttle-pricing policy now in effect was initially conceived to achieve full operational cost recovery over the 12-year total life cycle of the shuttle system.

From an economic perspective, this approach is not unreasonable—particularly from the standpoint of increasing the demand for launch services.

Having said that, one must also recognize that, to the extent that the Government subsidizes shuttle operations, it may serve to inhibit commercial development of alternative space transportation systems.

These conflicting policy requirements must be balanced in whatever shuttle-pricing policy is set for future launches.

This issue certainly merits further serious consideration by this committee.

What is clear is that recovery of total Government R&D costs in this program is economically inefficient and thus absurd. This conclusion can, and should, be applied to the broad issue of the commercialization of space launch systems.

Mr. Chairman, I realize that I'm speaking longer than I should, but I ask your indulgence to allow me to make one more very important comment. I feel quite strongly that the Office of Management and Budget is playing a de facto role in the formulation of U.S. space policy that is well beyond its mandate.

OMB's pessimism regarding the future market for shuttle launches has prevented NASA from procuring a fifth shuttle orbiter—a shortsighted decision, in my view, made worse by the fact that OMB's rationale may turn out to be a self-fulling prophecy.

How can we expect the commercial sector to develop new services exploiting space if it cannot be certain of the transportation system to haul its cargo?

In conclusion, Mr. Chairman, I would like to call your attention to a NASA study from September of last year, which concluded that we could lose as many as 94 launches to Ariane in the 1983 to 1994 time period, at an estimated cost of $3 billion.

In addition, U.S. companies might be less likely to win contracts for the development of the satellites to be launched. This loss, according to the study, could amount to as much as $9.92 billion over a 12-year period.

This year, Mr. Chairman, we are celebrating the 25th anniversary of the creation of NASA. In the beginning, we were the only country to whom someone could turn for launching a satellite.

Today, China, India, Japan, and the Europeans are in various stages of developing and perfecting their own launch vehicles. And the Soviet Union has shown interest in offering commercial launches as well. The fact is that the world marketplace for launch services has become competitive.

If we, as a Nation, are to respond to this challenge, we must change our way of thinking about the role of the Government and the private sector in space. We must be able to forge a true partnership between public and private interests in space and we must not fail to create a climate conducive to private sector investment in space.

Mr. Chairman, in closing, let me thank you very much for inviting me to testify here this afternoon.

[The prepared statement, plus answers to questions asked of Mr. Akaka follows:]

STATEMENT

OF

THE HONORABLE DANIEL K. AKAKA

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
U.S. HOUSE OF REPRESENTATIVES

"THE COMMERCIALIZATION OF SPACE LAUNCH SYSTEMS"

MAY 17, 1983

Mr. Chairman and Members of the Subcommittee: I want to take this opportunity to thank you for asking me to share my views on the issue of commercialization of space launch systems with you. As ~~I'm sure~~ you know, I have some very definite opinions on that subject--opinions which I am delighted to share today. Mr. Ch)

The importance of this issue to the long-term future of our nation's space effort cannot be overstated. The decisions we make today will surely determine the shape of the future. If we fail to make those decisions in good faith, with the courage and foresight required to guarantee success, we have only ourselves to blame. If we fail to confront these challenges head-on, we can and should be held responsible for a future decline in our nation's space enterprise.

It is crystal clear that, with the development of an operational space transportation system, we have entered into a new era of space enterprise--one which is filled with many dreams. We are now thinking about projects none of us could have imagined 25 years ago. This new era of space enterprise demands new technologies, new attitudes and new ways of managing our resources if we are to achieve the goals of our emerging vision of our future in space.

We cannot continue to try to shape the future using only the tools of the past. We cannot allow our drive and our ability for creating a new world in space to be crippled by our desire to cling to the ways of the past. If we are to profit from the glorious, intoxicating success of our space program, we must take risks. And, when you come right down to it, taking risk for the sake of our future in space is really what this hearing is all about.

There can be no doubt that a national policy decision to commercialize space launch systems is an action which carries with it a certain amount of risk. At the heart of this issue are risks which apply to both the public and the private sectors of our economy.

In the case of the commercialization of expendable launch vehicles (ELVs), the risks for the government are not obvious. Since a policy decision to phase out the use and production of the ELVs by 1986 was made, it stands to reason that the government would have nothing to lose by simply turning the ELV segment over to the private sector. Although this conclusion is a reasonable one, it neglects an important consideration: if the ELVs are turned over to the private sector for the purposes of complementing launch services provided by the shuttle, and if the government then relies on these services to supplement shuttle capability, what happens to the government launch operations if, at some point in the future, the private sector cannot deliver backup launch services when needed? Who will take on the responsibility for continuing research and development in the expendable field? (Can national security interests continue to be protected if launch systems are commercialized?) Should the federal government be willing to take the risk of being responsible, under the terms of the Outer Space Treaty, for possible damages to a third party stemming from a failed commercial launch? And, finally, there is the important question of the extent to which commercialization of the ELVs expendables will take potential payloads away from the government-developed shuttle.

These are risks not to be taken lightly.

For the private sector, many of the risks involved in commercializing ELVs are fairly straightforward.

First and foremost is the question of whether or not there is a real market for commercial expendable launch services. In the industry estimates vary. It is impossible to know if the availability of commercial launch services will generate future demands for their use.

A second critical risk is the question of shuttle pricing policy and whether or not the government will, once committed to the commercialization of ELVs, carry out its decision to commercialize in good faith. For example, there is nothing to guarantee that the government won't raise the cost to the private sector of running expendable operations while at the same time further subsidizing and thus lowering the cost of flying on the shuttle. This strategy would obviously force any commercial ELV operation right out of the market place into the arms of serious financial loss. Commercial operators of ELVs may also run the risk of having the government commandeer some of its scheduled launches capriciously, in the name of urgent national need. Any such preemptive action on the part of the government would certainly disrupt private sector operations in terms of both scheduling and revenues.

It is clear that, in the case of the commercialization of expendable launch vehicles, risk cuts both ways.

The question is: Are these risks worth taking?

The answer is very simple. Just look at the results of failing to take these risks.

Every member of this Subcommittee has before him a brochure which, in the space community, is unsurpassed in its elegance, style and approach. The brochure you have before you lists the advantages of using Arianespace for launches. I urge you to take the time to read this document carefully . . . read it and then tell me, if you owned a satellite and were looking for launch services, whether or not you could resist booking on Arianespace. My instincts tell me that resistance would be difficult.

One of the many strengths of the marketing strategy used by Arianespace is its ability to point out the current weaknesses in the operations of our shuttle system. In January of 1982, the President of Arianespace sent a letter to the Colombian Ministry of Communications in an effort to secure a commitment to launch on Ariane. I ask that the full text of this communique be inserted in the record, and will take this opportunity to highlight the arguments used by Ariane:

--that "SATCOL" (the satellite in question) is not included in NASA's program, and therefore would have to yield priority to other satellites.

--that DOD enjoys absolute priority and at any moment can override any other satellite.

--that an "incident" on the shuttle could immobilize the entire fleet and delay a launch for months.

--that the NASA estimates for turn-around time have always been optimistic and delays are likely.

--that the preparation of the interface for a satellite is a long and difficult task and can take four entire months prior to launch.

--that a price increase is certain to occur--maybe as much as 50 percent.

--and finally, that "It can be proven that there isn't a single user of a new space system that has placed its confidence to launch all satellites on Shuttle."

These are issues which can, in part, be successfully addressed by pointing to a reliable backup capability for the space shuttle.

The fact is that the European space community, through ESA and Arianespace, is rapidly demonstrating that it will be able to provide commercial launch services to the world community on a regular basis. While there are those who might claim that Arianespace launch capabilities need not be taken seriously due to the failure of two out of its five launches, these failures probably represent simple perturbations common to any new venture.

In September of 1982--only eight months ago--a top level NASA study concluded that the U.S. could lose a maximum of 94 launches to the European Ariane launch vehicle in the 1983-1994 period at an estimated cost of $3 billion. The study further pointed out that in addition to the loss of $3 billion in launch charges, it was also probable that as a result the U.S. would be less likely to win contracts for development of these communications satellites to be launched on Ariane. This loss to the total economy could amount to as much as $9.92 billion over a 12-year period.

Our policies and procedures for the exploration, use and development of space were formulated for the most part

25 years ago with the passage of the act creating NASA. At that time, the U.S. Government had a corner on 100 percent of the free world market for launch services.

Today, we are no longer the only nation with a capability of providing launch services: Japan, China, India and the European Space Agency are all at various stages of developing and perfecting their launch capabilities. The Soviet Union, which of course has been launching longer than we have, is now offering launch services on a commercial basis. The fact is that the world marketplace for launch services has become competitive. If we, as a nation, are to respond to this challenge, we must change our way of thinking about the role of the government and the private sector in space. We must be able to forge a true partnership between public and private interests in space. And, we must not fail to create a climate conducive to private sector investment in space.

The Senior Interagency Group (SIG) has been examining the question of commercialization of launch services for the past few months and made their recommendations this weekend. While I am certainly pleased with the SIG recommendation to proceed with the commercialization of ELVs, I am aware that a mechanism must be found to properly implement this policy. The major problem with policy directives is that they are, in general, useless, unless they are accompanied by a concrete plan for implementation.

If we are to commercialize space launch systems successfully, then we must put in place the operational mechanisms which create, by force, the necessary climate in which the private sector will be allowed to succeed. This principle applies to both the commercialization of existing ELVs and vehicles which are the result of new technologies and new methods of launch, as well as to the shuttle itself. In fact, this principle applies to every area and activity in which private sector participation is desirable.

First, the federal government must offer a way for the private sector to see its way clear to making a profit in space. By definition, this means determining the worth of government assets and services at market value or even at cost. It is not reasonable to expect the private sector to foot the bill for sunk R & D costs. Where leasing of facilities and services are concerned, the federal government should keep its prices fair and reasonable . . . meaning not prohibitively expensive.

Second, the federal government must make a commitment, both in policy and practice, to make life as easy as possible for the entry of the private sector into space and space launch services. This means that unnecessary and excessive red tape must be eliminated. Regulations must be altered to be uniform, clear and simple, and the entire regulatory process for launch clearance and payload approval must be streamlined.

Within the federal government, an agency must be chosen to act as the lead agency in matters regarding regulation of private companies seeking launch clearances. A single point of contact must be established in order to avoid costly and time-consuming duplication of paperwork and redundant regulation. Each federal agency with statutory responsibilities must further have its role clearly defined. This role should be one of minimal interference; in fact, the decision on whether to grant or deny launch approval should be limited to consideration of the following issues: public safety, national security, insurance coverage, indemnification and the balancing of competing interests of airspace users.

The regulatory process itself must be streamlined. Launch sites and specific classes of vehicles can and should be issued permits and clearances on a one-time basis for a sequence of routine launches. Approval of launch sites, vehicles and operations should be granted, or denied, in a timely fashion; which is why I suggest that mandatory time limits for processing applications be set. Now is also the time to start making decisions on insurance levels to be required, range safety procedures and means of indemnification.

The fact is, until these issues are confronted squarely by the federal government, we have no hope at all of being able to create a climate in which the private sector can successfully enter the space launch business.

I introduced H.R. 1011, the Space Commerce Act, as a logical first step in confronting these issues. The fact is that in August of 1981, when Space Services, Inc. sought clearances to obtain permission for a test suborbital launch, the federal government had no policies or clear-cut procedures for granting these clearances. SSI was forced to obtain regulatory permissions, clearances and approval from five different agencies or bodies: The Federal Aviation Administration, the Department of State, the Federal Communications Commission, NASA and the North American Aerospace Defense Command. Furthermore, the company had to register with the Bureau of Alcohol, Tobacco, and Firearms as well as with the Internal Revenue Service. As a result of this lack of a streamlined procedure, it took this particular company over six months and a quarter of a million dollars to receive clearance to launch a test flight.

This kind of unnecessary red tape entails costly delays and might discourage private sector investment in the space launch business.

H.R. 1011 recommends the Department of Commerce as the lead agency. As peculiar as this recommendation may seem to some, it is based both on common sense and the elimination of all other possibilities.

It is not appropriate for the Department of Defense to assume the lead agency role. Regulation of the private sector is not one of the DOD mandates and I'm sure the DOD has better things to do than certify launch sites, vehicles, and promulgate regulations.

The Federal Communications Commission does play a significant role in issuing licenses for the use of necessary communications frequencies. The FCC's role is very specific and its expertise in other space areas is limited; this Commission has neither statutory authority outside the communications field nor necessary technical expertise to operate as the lead agency.

The Federal Aviation Administration, while at first glance a likely candidate, has as its primary responsibility air safety. Furthermore, the FAA would have no jurisdiction over launches taking place from installations controlled by the Department of Defense or those outside the continental U.S. The FAA has no procedures for clearing rocket launches, and even at the FAA, technical expertise in the field of space launches is limited.

Of all the agencies, the one most likely to make sure that a proper business and regulatory climate is never created for private sector activities is the Department of State. Furthermore, State has neither a regulatory charter nor the technical capability to assume a lead agency role in regulating commercial space launches. Some have even questioned to what extent the Arms Export Control Act should be applied to the launch of sounding rockets and suborbital flights.

Although the State Department does have a significant role to play with regard to adherence to international treaties and agreements, to designate State as the lead agency and initial point of contact is tantamount to saying that we really don't want to encourage private sector involvement in space launch systems. Many currently make the claim that the State Department cannot handle the policy responsibilities it already has for setting space policy. Witness the continuing controversy over the State Department's role in coordinating U.S. policy for international telecommunications. The State Department has been heavily criticized for its inability to set forth clear U.S. policy in international telecommunications issues and avenues are being explored to relieve State of this responsibility. I am and will continue to be categorically opposed to any move to assign either lead agency responsibility or initial point of contact responsibility to the Department of State.

As a third party agency, the Department of Commerce is an obvious choice for both an initial point of contact and a lead agency function which could be merged in the long-term. Commerce also has the advantage of having a regulatory charter which permits this activity. Lead agency designation does not mean that the designated agency could abrogate the basic responsibilities of the other agencies involved in regulating specific areas of private launches. Lead agency designation simply means that the agency would take the lead on the process of granting permission to launch, would coordinate the issuing of permits and would guarantee and oversee a streamlining of the entire process. As such, the Department of Commerce would be responsible for checking with all the other agencies and getting their specific clearances in their areas of expertise. Another point in Commerce's favor is that when we talk about space launching services, we are talking about business . . . about commerce and about trade. We are talking about the birth of a new industry in this country. As such, from a philosophic and policy point of view, this industry belongs under the Department of Commerce.

The major issue to be addressed is the fact that the Department of Commerce has no expertise in the area of space launch services. This is not the obstacle it might appear to be, for as far as developing policy and procedures for private sector launches is concerned, no other agency has any more expertise in the regulation of private sector launches, for this industry is a brand new one.

Knowing well that creating a set of policies and procedures for developing and regulating this new industry will be very long and complicated task, I suggest that a working group be established among the cognizant agencies to coordinate the development and implementation of these policies. For the interim, I also believe that NASA should be the initial point of contact, until a mechanism can be developed to put a streamlined regulatory process in place.

I have always made the argument, and will continue to make it, that a Bureau of Commercial Space Activities should be created at the Department of Commerce. Those who oppose this proposal cite the fact that Commerce has no technical expertise, that we live in times of serious budgetary constraint and that we cannot afford the extra funding this move would entail. These arguments are irrelevant. The fact is that we know where the experts are: they are at NASA, at State, at DOD, at FCC, and at FAA. All we have to do is to assemble under one roof the selected personnel from each of the appropriate agencies. This can be done through a simple legislative authorization and through reprogramming of positions. As a Member of the House of Representatives, and as a Member of the House Appropriations

Committee, I lend my full support to such a reorganization.

Thus, a Bureau of Commercial Space Activities could be created at very little additional expense. The Bureau of Commercial Space Activities, housed in the Department of Commerce, would then be superbly qualified to act as an initial point of contact and a lead agency. If, in the future, commercial activity escalates to the point where it becomes a significant and leading industry for the United States, the Bureau of Commercial Space Activities could then be spun off and accorded full agency status as the Commercial Space Agency. Although this may be as far away as 20 or 30 years from now, we must make it part of our vision of the future, for we have many planning and policy issues to settle. We must lay the foundation for the future.

The bulk of my testimony today has been devoted to the commercialization of expendable launch vehicles. As far as commercialization of the shuttle is concerned, I think it is inevitable.

The questions are: Is now the right time? Is the shuttle truly operational? Are the glitches truly out of the system? Are we ready to turn the operation of the system over to the private sector? These questions need answers. For my part, I simply don't know. What is clear, however, is that NASA is an R & D agency by design and by statute. In the long-term, commercial operations do not belong in NASA unless we redefine the mission of the agency. The private sector undoubtedly has a great deal to contribute to the shuttle marketing operation in the meantime. Such proposals deserve serious consideration by this Administration and Congress.

We have a great deal of money invested in our shuttle programs. According to NASA, the total costs for research, development, test and evaluation of the shuttle were $10.1 billion, in real year dollars. This is a sizeable investment and one which we cannot afford to throw away. Shuttle pricing policy now in effect was initially conceived to achieve full operational cost recovery over the 12-year total life-cycle of the shuttle system.

From an economic perspective, this approach is not unreasonable--particularly from the standpoint of increasing demand for launch services. Having said that one must also recognize that, to the extent that the government subsidizes shuttle operation, it may serve to inhibit commercial development of alternative space transportation systems. These conflicting policy requirements must be balanced in whatever shuttle pricing policy is set for future launches.

This issue certainly merits further serious consideration by this Committee.

What is clear is that recovery of total government R & D costs in this program is economically inefficient and thus absurd. This conclusion can and should be applied to the broad issue of the commercialization of space launch systems.

Government R & D in this program, as in all programs, benefits a wide variety of users and it is unreasonable to require only the direct users to bear the full cost of the research.

Mr. Chairman, one point I feel I really must raise is the effect that the Office of Management and Budget is having in the creation of de facto national space policy by its arbitrary and often inconsistent fiscal directives to NASA. OMB, by clearly failing to consider the implications of its actions, had adopted the worst of all possible approaches to maintaining U.S. pre-eminence in space transportation. By refusing to accept or promote the commercialization of the shuttle in any time-frame, OMB has forced NASA to adopt a commercial role and yet OMB has dictated that NASA not develop the market demand for the shuttle to such an extent that a fifth orbiter would be required. Thus, OMB is forcing NASA to play an unnatural role and insisting that the agency play it poorly. This can only benefit foreign competitors to the U.S. space shuttle.

OMB's pessimism regarding the future market for shuttle launches is unwarranted, but, by virtue of OMB's power in policy matters, may become a self-fulfilling prophecy.

Mr. Chairman, I commend this Committee for its vigorous examination of issues relating to space commercialization. I can only hope that your effort will insure that in the future a strong and coherent space policy will guide the action of our nation in space and that it will not be guided by the myopic directives of fiscal bureaucrats.

Mr. Chairman, in this rather lengthy testimony I have tried to highlight what I believe are the policy issues before this Committee. I have tried to identify the risks inherent to the commercialization of launch services for both the public and private sectors, and I have tried to point out what I believe are the consequences of failing to take these risks. I firmly believe that we have no choice but to engage in risk. Our future in space depends on our will to take a leadership role in commercial space activity. As far as H.R. 1011 is concerned, I continue to believe that this is a piece of legislation whose passage is important to the future of our nation's space effort.

While the terms of H.R. 1011 may need to be amended as a result of information unveiled in these hearings, I firmly believe that it is the responsibility of Congress, not the Administration, to set the terms of policy and procedures governing private sector space launches.

If we fail to enact legislation, and if the Administration sets policies and procedures by fiat or by executive order, who is to say that the next Administration won't have a change of heart and discourage commercialization of launch systems? Who can guarantee that Administration policy will not serve to discourage, rather than encourage commercialization, in order to protect what it views as the interests of the shuttle? And finally, I ask you: given the Administration's obvious lack of judgment of the issue of commercialization of our remote sensing capabilities, who can tell me that this Administration shows good judgment in the area of commercial space activities?

It is for these reasons that I believe that Congress must act on this issue. I, therefore, support passage of legislation which clearly sets forth policy on the commercialization of space launch systems.

Mr. Chairman, this concludes my formal testimony. For the record, I have submitted formal documentation on all the clearances, permits and permissions required for a private sector launch. I have also included responses from the FCC, FAA and NASA regarding their respective roles in granting launch permissions, as well as a copy of the letter sent from the President of Arianespace to the Colombian Ministry. I ask that these documents be included in the record of this hearing.

Thank you very much.

THE HONORABLE DANIEL K. AKAKA
RESPONSES TO QUESTIONS FOR THE RECORD
SPACE COMMERCIALIZATION HEARING
MAY 17, 1983

1. What are your reasons for suggesting that the Department of Commerce be the primary point of contact for commercialization licenses? Why do you think that Commerce is better than the State Department for this role?

I recommend that the Department of Commerce act as both the primary point of contact for commercial space activities and also as the lead agency in the regulatory process. This recommendation is based on both common sense and the elimination of all other possibilities.

It is not appropriate for the Department of Defense to assume the lead agency role. Regulation of the private sector is not one of the DOD's mandates and I'm sure the DOD has better things to do than to certify launches, sites, vehicles, and promulgate regulations.

The Federal Communications Commission does play a significant role in issuing licenses for the use of necessary communications frequencies. The FCC's role is very specific and its expertise in other space areas is limited; this Commission has neither the statutory authority outside the communications field nor the necessary technical expertise to operate as the lead agency.

The Federal Aviation Administration, while at first glance a likely candidate, has as its primary responsibility air safety. Furthermore, the FAA would have no jurisdiction over launches taking place from installations controlled by the Department of Defense or installations outside the continental United States. The FAA has no procedures for clearing commercial rocket launches, and even at the FAA, technical expertise in the field of commercial space launches is limited.

Of all the agencies, the one most likely to make sure that a proper regulatory and business climate is never created for private sector activities in space is the Department of State. State has neither the regulatory charter nor the technical capability to assume either an initial point of contact or lead agency role in the regulation of commerical space launches. Some have even questioned to what extent the Arms Export Control Act should be applied to the launch of sounding rockets and suborbital flights.

Although the State Department does have a significant role to play with regard to adherence to international treaties and agreements, to designate the State Department as the lead agency and initial point of contact may be tantamount to saying that we really don't want to encourage serious private sector involvement in the development and use of commercial space launch systems. Many currently make the claim that the State Department cannot handle the policy responsibilities it already has for setting space policy--witness the current controversy over the State Department's role in coordinating U.S. policy for international telecommunications. The State Department has been heavily criticized for its inability to set forth clear U.S. policy in international telecommunications issues.

As a third party agency, the Department of Commerce is an obvious choice for both an initial point of contact and a lead agency. In the long-term, these two functions could be merged. Commerce also has the advantage of having a regulatory charter which permits this activity. Lead agency designation does not mean that the designated agency could abrogate the basic responsibilities of other agencies already having jurisdiction over specific aspects of the launch process. Lead agency designation simply means that the agency in question would simply take the lead on the process of granting permission to launch, would coordinate the issuing of permits and clearances and would guarantee and oversee a streamlining of the entire process.

A third major point in Commerce's favor is that when we talk about space launching services to be provided by the private sector, we are talking about business...about commerce and about trade. We are talking about the birth of a new industry in this country. As such, from a philosophic and policy point of view, the management, regulation and general supervision of this industry belongs in the Department of Commerce.

The major issue to be addressed is the fact that the Department of Commerce has no obvious expertise in the area of commercial space launch services. This is not the obstacle it might appear to be, for as far as developing policies and procedures for private sector launches is concerned, no other agency has any more expertise in the regulation of private sector launches, for this industry is a brand new one.

Knowing well that creating a set of policies and procedures for developing and regulating this new industry will be a very long, arduous and complicated task, I suggest that a working group be established among the cognizant agencies to coordinate the development and implementation of these policies. For the interim, I also believe that NASA should function as the initial point of contact, until a mechanism can be developed to put a streamlined regulatory process in place.

I have always made the argument, and will continue to make it, that a Bureau of Commercial Space Activities should be created at the Department of Commerce. This can be done either through legislative action or by reorganization at the Department of Commerce. If, at any point in the future, commercial space activity escalates to the point where it becomes a significant and leading industry for the United States, the Bureau of Commercial Space Activites could then be spun off and accorded full agency status as the Commercial Space Agency. Although this may be as far away as twenty or thirty years from now, we must make it part of our vision of the future, for we have many planning and policy issues to settle. We must lay the groundwork to build a foundation for the future.

2. Do you think that licenses should be issued for each private launch or should a license cover a particular period and specific class of launch vehicle?

A truly streamlined regulatory process demands that, where appropriate, licenses be issued to cover both a specific period and a specific class of launch vehicle. It does not make sense for companies to be forced to resubmit applications containing information already conveyed to the licensing agency for a specific class of vehicle and launch site. It may, therefore, be appropriate to issue licenses to a launch site, as well as to a specific class of vehicle to be launched during a specified time period. Once certified, the launch site would not have to be certified again, providing that no changes of either equipment or procedure had been made. Obviously, the appropriate agencies must be kept notified regarding the times and dates of launches; proposed launches must be cleared for specific times and dates.

In short, issuing a license for a class of vehicle and a specific site will certainly help to streamline the process of launch approval.

3. In light of the recently completed studies by NASA, the National Academy of Public Administration and the Senior Interagency Group, do you still see the need to establish a Commercial Space Study Commission?

In light of recent action, no. If, however, it becomes obvious that, in spite of all the studies which have been done, there is no mechanism for putting into action all the policy recommendations, then I would favor the establishment of a Commission. It is critically important that policy directives be translated into procedure. If this cannot be done with the results of the current studies, then and only then would I favor the creation of a new study commission.

4. Whatever the decision concerning a lead agency for space commercialization matters, do you think that NASA should establish a commercialization office? If so, to what level in NASA should it report?

If we are to encourage the commercialization of space launch systems, then it is critically important that NASA establish an office of commercial space activities. This office, once established, should report directly to the Administrator of NASA to insure that proper action is taken both quickly and effectively to promote the development of commercial space activities. There must not be several layers of bureaucracy and red tape between the NASA Office of Commercial Space Activites and the Administrator.

Mr. **Volkmer**. Thank you very much, Congressman Akaka. We will now hear from Lieutenant General Abrahamson.

STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON, ASSOCIATE ADMINISTRATOR FOR SPACE FLIGHT, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

General **Abrahamson**. Thank you, Mr. Chairman. I would like to read my statement because it does provide a basis that I think may be useful to the subcommittee as you proceed through questions.

Before I do, however, I'd like to introduce Mr. "Bud" Evans, who is Special Assistant to Mr. Beggs for commercialization and who has been there working on the problem for some time; and Mr. "Ike" Gillam, who is my Deputy for Policy and Planning and who has been working very effectively in several areas in commercialization within our office.

Mr. Chairman, and members of the subcommittee, I am pleased to appear before this subcommittee to participate in your hearings on this important subject of commercial activities in space. As you know, the Office of Space Flight has had significant involvement in the evolution of commercial activities in space ranging from providing launching services to communications satellites to private sector investment in the development of upper stages such as the Payload Assist Module [PAM-D] which was used to place the spacecraft on STS-5 in geosynchronous orbit and other aspects of launching systems such as the development of the upgraded configuration of the Delta vehicle.

We believe that we are truly at the beginning of a new phase in our national space efforts—the exploitation of space. In this exploitation phase, there is a vital role for the private sector.

I firmly believe that the full promise and the potential benefit of space activities can only be realized as we harness the engine of commercial enterprise, in partnership with our Government efforts. In a proper and mutually rewarding relationship, this partnership will assure continued U.S. leadership in space.

Therefore, I fully support the national goal of expanding U.S. private sector investment and involvement in civil space and space-related activities, as announced in the National Space Policy on July 4, 1982.

NASA has made an excellent start in this expansion through joint endeavor agreements, technical exchange agreements, and our industrial guest investigator process. These approaches hold great promise in developing the appropriate cooperative relationship that I mentioned between the Government and the private sector.

As an example, a few weeks ago, the Office of Space Flight entered into a cooperative agreement with the Orbital Systems Corp. for the development of a Transfer Orbit System [TOS] to be utilized as a new upper stage for the Space Transportation System.

This cooperative agreement, patterned after its predecessor, the PAM-D agreement with McDonnell Douglas, establishes the ground rules for the private sector development and marketing of an upper stage for use with the space shuttle which will accommodate payloads larger than the PAM but smaller than those which might require the Centaur stage.

The Office of Space Flight is involved in many other discussions with prospective private sector proposals on efforts directly associated with the STS.

Orbital Systems Ltd. of Lanham, Md., has proposed an environmental monitoring system for the shuttle payload bay. This system is to function in a manner similar to the flight recorder on a commercial aircraft.

The Fairchild Corp. has proposed a shuttle-tended, mobile, unmanned space platform which is supported by ground based systems and services.

The platform will be available for lease and could be utilized for scientific instruments, materials processing or remote sensors.

Mr. Chairman, I believe that the proposals such as these and the McDonnell Douglas and Johnson and Johnson continuous flow electrophoresis experiments are of prime importance because they augment and exploit the unique opportunities provided by the space shuttle. Therefore, I feel that the space shuttle is a key to the development of new products or services and other national benefits that can be derived from increased commercial activity in space.

Along with prospective operators of commercial ELV's, these endeavors represent true commercialization in the sense that they each can create new commercial products or services and, to varying degrees, may add new dimensions to our store of space technology.

In adding to these new dimensions of our store of space capability, some people and institutions involved are tackling very significant development risks as well as market risks. Therefore, in these instances, it is appropriate and consistent with NASA's technology mandate to provide the assistance and encouragement that our joint endeavor and other agreements provide.

By the same token, their success adds to the capability of the STS, while avoiding the requirement for Federal funding. So long as we can proceed on this approach equitably and properly, this is the powerful mutual reinforcement of government and private efforts that I feel can assure U.S. space leadership.

As I indicated, these shuttle-related proposals are consistent with the commitment and the investment made in the STS over the last decade.

Now, regarding the STS itself, we have not received any private sector proposals which involve its day-to-day operation. Several internal reviews have been conducted on this possibility. The most recent reviews were a part of the overall effort which resulted in the national space policy. These reviews concluded that it is premature to consider such an alternative until the STS has reached a sufficient state of maturity to allow the system to be considered self-sustaining. Each of these reviews independently reached that conclusion and considered that the time to consider the transfer of operation to the private sector should be at some point in the future and that should not be precluded. We are insuring that our programmatic actions are in keeping with this principle.

As you know, we have also received from the Space Transportation Co. a proposal to fund a fifth orbiter. I use the word "proposal" because it has often been described as such; however, the original submission did not meet the criteria normally used by NASA when it uses the term "proposal". We conducted a series of discussions with the representatives of the Space Transportation Co. with a view toward gaining a better understanding of the concept proposed. As a result of those discussions, NASA has outlined a series of concerns and issues for consideration for such a proposal.

As you might imagine, the issues are involved with the exercise of priority for security and other Government time-critical launches, the exclusivity of any agreement; the pricing and its relationship to an appropriate return on investment, as well as proper cost reimbursement to the Government; the impact on our space shuttle customers; and, of course, our prime consideration: safe and effective operation of the STS.

Our present status is that we have recently received from the Space Transportation Co. a set of "Proposed Principles for Incorporation into a Definitive Agreement of the SpaceTran Procurement of an Orbiter". We are reviewing this set of principles and intend to continue our discussions, if there appears to be a mutually satisfactory conclusion in sight.

We have also received several proposals associated with private sector entities assuming the marketing function for the STS. We have delayed the completion of the evaluation of these proposals until we have established an Agency position on the best method for accomplishing this marketing function. We expect this within the next month or so and then we will proceed with a more formal evaluation process.

Regarding proposals which have been received by the Government which involve the establishment of new launch systems from new launch sites, NASA has served as an adviser to the Federal Aviation Administration, the Federal Communications Commission and the Department of State on the technical characteristics of these proposals as each of these agencies exercises its respective regulatory role. NASA may also provide technical advice to the proposer upon request and as agreed to by NASA. In addition, NASA participated in an interagency effort, led by the Department of State, to review the existing regulatory and licensing process as it applied to the license request of Space Services Inc. for the launch of their Conestoga I launch vehicle from Matagorda Island in September of last year. Although at the time the concensus of the interagency group was that the existing licensing procedures were adequate, it is readily apparent within this same interagency group that there areas in this Government approval process that can be streamlined. I believe the involved agencies are fully prepared to undertake the streamlining process under the auspices of a Senior Interagency Group Working Committee. And, NASA will continue to support that effort and to encourage it.

We have begun the phaseout of the Delta vehicle by taking action to stop production of vehicles beyond our known requirements. The DOD has recently announced that it is stopping the production of the Titan vehicle. These actions have been taken in accordance with a longstanding plan to transition from the operation of expendable launch vehicles to the STS. As a result of a number of requests from industrial organizations, venture capital firms and others, NASA is studying the question of transfer of these systems to private operators. Shortly after the NASA study began, a Senior Interagency Group Space Working Group also began to look into this question.

I fully support the recently announced policy concerning the private sector operation of the expendable launch vehicles currently operated by the Government. There is a reasonable question about the potential impact of such an action on the space shuttle. Although I am naturally concerned about the competition, the policy establishes a clear operating framework with respect to the STS and the commercially operated expendable launch vehicles. In particular, it confirms that the pricing policy for the shuttle will be maintained. This is a fundamental anchor point in that it provides confidence for our shuttle customers, and a firm business planning base for potential expendable launch vehicle privatization endeavors. Therefore, I am confident that the STS, with all its past investment and promise for the future, can go forward, and that private launch vehicle ventures can also flourish where they best fill a market need or complement the shuttle.

Mr. Beggs, in his earlier testimony to this subcommittee on May 3, 1983 stated:

> We must, however, proceed with caution as we enter this relatively new arena. Although I wholeheartedly believe that the time has come to encourage and support expansion of commercial involvement in space activities, it is imperative that we develop sound guidelines by which this expansion takes place.

I fully support the thrust of Mr. Beggs' statement and will enthusiastically support the Agency's efforts to establish those guidelines and, at the same time, insure that every reasonable approach proposed by the private sector is provided adequate consideration and opportunity.

Mr. Chairman, we intend to continue our efforts to increase the involvement of the U.S. private sector in civil space activities with a view for the national economic benefit and to fully exploit the capabilities of the space transportation system.

And, with that, I am pleased to respond to your questions.

[The prepared statement of General Abrahamson follows:]

STATEMENT OF
LIEUTENANT GENERAL JAMES A. ABRAHAMSON
ASSOCIATE ADMINISTRATOR
FOR SPACE FLIGHT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

BEFORE THE

Subcommittee for Space Science and Applications
Committee on Science and Technology
House of Representatives

Mr. Chairman and Members of the Subcommittee:

Mr. Chairman, I am pleased to appear before this subcommittee to participate in your Hearings on the important subject of commercial activities in space. As you know, the Office of Space Flight has had significant involvement in the evolution of commercial activities in space ranging from providing launching services for communications satellites to private sector investment in the development of upper stages such as the Payload Assist Module (PAM-D) used to place the spacecraft on STS-5 in geosynchronous orbit and other aspects of launching systems such as the development of the 3914 configuration of the Delta vehicle.

We believe that we are truly at the beginning of a new phase in our national space efforts, the exploitation of space. In this exploitation there is a vital role for the private sector. I firmly believe that the full promise and the potential benefit of space activities can only be realized as we harness the engine of commercial enterprise, in partnership with our government efforts. In a proper and mutually rewarding relationship, this partnership will assure continued U.S. leadership in space. Therefore, I fully support the national goal of expanding U.S. private sector investment and involvement in civil space and space-related activities, as announced in the National Space Policy on July 4, 1982. NASA has made an excellent start in this expansion through joint endeavor agreements, technical exchange agreements, and our industrial guest investigator process. These approaches hold great promise in developing the appropriate cooperative relationship, I mentioned, between the Government and the private sector. As an example, a few weeks ago, the Office of Space Flight entered into a cooperative agreement with the Orbital Systems Corporation for the development of a Transfer Orbit System (TOS) to be utilized as an upper stage with the Space Transportation System (STS). This cooperative agreement, patterned after its predecessor, the PAM-D agreement with McDonnell Douglas, establishes the ground rules for the private sector development and marketing of an upper stage for use with the Space Shuttle which will accommodate payloads larger than the PAM but smaller than those which might require the Centaur stage.

The Office of Space Flight is involved in many other discussions with prospective private sector proposers on efforts directly associated with the STS. Orbital Systems Ltd. of Lanham, Maryland has proposed the environmental monitoring system for the Shuttle payload bay. This system is to function in a manner similar to the flight recorder on commercial aircraft. The Fairchild Corporation has proposed a Shuttle-tended, mobile, unmanned space platform which is supported by ground based systems and services. The platform will be available for lease and can be utilized for scientific instruments, materials processing or remote sensors. Mr. Chairman, I believe that proposals such as these and the McDonnell Douglas/Johnson and Johnson continuous flow electrophoresis experiments are of prime importance because they augment and/or exploit the unique opportunities provided to us by the Space Shuttle. I feel, therefore, that the Space Shuttle is a key to the development of new products or services and other national benefits that can be derived from increased commercial activity in space. Along with prospective operators of commercial ELV's, these endeavors represent true commercialization in the sense that they each create new commercial products or services and to varying degrees add new dimensions to our store of space technology. In adding this new dimension to our space capability, some people and institutions involved are tackling significant development risks as well as market risks. Therefore, in these instances it is appropriate and consistent with NASA's technology mandate to provide the assistance and encouragement that our joint endeavor and other agreements provide. By the same token, their success adds to the capability of the STS, while avoiding the requirement for federal funding. So long as we can proceed in this approach equitably and properly, this is the powerful mutual reinforcement of government and private efforts that I feel can assure U.S. space leadership. As I indicated, these Shuttle-related proposals are consistent with the commitment and investment made in the STS over the last decade.

Regarding the STS itself, we have not received any private sector proposals which involve its day-to-day operation. Several internal reviews have been conducted on this possibility. The most recent reviews were a part of the overall effort which resulted in the National Space Policy. These reviews concluded that it is premature to consider such an alternative until the STS has reached a sufficient state of maturity to allow the system to be considered self-sustaining. Each of these reviews independently reached the conclusion that it is premature to consider the transfer of operation of the STS to the private sector, but that such a transfer in the future should not be precluded. We are insuring that our programmatic actions are in keeping with this principle.

As you know, we have received from the Space Transportation Company a "proposal" to fund a fifth orbiter. I use the word "proposal" because it has often been described as such; however, the original submission did not meet the criteria normally used by NASA when it uses the term proposal. We conducted a series of discussions with the representatives of the Space Transportation Company with a view toward gaining a better understanding of the concept proposed. As a result of those discussions, NASA has outlined a series of concerns and issues for consideration for such a proposal.

As you might imagine, the issues are involved with the exercise of priority for security and other government time-critical launches, exclusive of any agreement; pricing and its relationship to appropriate return on investment, as well as proper cost reimbursement to the Government; the impact on our Space Shuttle customers; and, of course, our prime consideration -- safe and effective operation of the STS.

Our present status is that we have recently received from the Space Transportation Company a set of "Proposed Principles for Incorporation in a Definitive Agreement of the SpaceTran Procurement of an Orbiter." We are reviewing this set of principles and intend to continue our discussions if there appears to be a mutually satisfactory conclusion in sight.

We have also received several proposals associated with private sector entities assuming the marketing function for the STS. We have delayed the completion of the evaluation of these proposals until we have established an Agency position on the best method for accomplishing this marketing function. We expect this within the next month or so, and then we will proceed with a more formal evaluation process.

Regarding proposals which have been received by the Government which involve the establishment of new launch systems from new launch sites, NASA has served as an advisor to the Federal Aviation Administration, the Federal Communications Commission, and the Department of State on the technical characteristics of these proposals as each of these agencies exercises its respective regulatory role. NASA may also provide technical advice to the proposer upon request and as agreed to by NASA. In addition, NASA participated in an interagency effort, led by the Department of State, to review the existing regulatory and licensing process as it applied to the license request of Space Services Incorporated for the launch of their CONESTOGA I launch vehicle from Matagorda Island in September of last year. Although at the time the consensus of the interagency group was that the existing licensing procedures were adequate, it is readily apparent within this same interagency group that there are areas in this Government approval process that could be streamlined. I believe the involved agencies are prepared to undertake the streamlining process under the auspices of a Senior Interagency Group Working Committee. NASA will continue to support the effort and to encourage it.

We have begun the phase-out of the Delta vehicle by taking action to stop production of vehicles beyond our known requirements. The DOD has recently announced that it is stopping the production of the Titan vehicle. These actions have been taken in accordance with a longstanding plan to transition from the operation of expendable launch vehicles to the STS. As a result of a number of requests from industrial organizations, venture capital firms and others, NASA is studying the question of transfer of these systems to private operators. Shortly after the NASA study began, a Senior Interagency Group (SIG) Space Working Group also began to look into this question.

I fully support the recently announced policy concerning the private sector operation of the Expendable Launch Vehicles currently operated by the Government. There is a reasonable question about the potential impact of such an action on the Space Shuttle. Although I am naturally concerned about the competition, the policy establishes a clear operating framework with respect to the STS and the commercially operated Expendable Launch Vehicles. In particular, it confirms that the pricing policy for the Shuttle will be maintained. This is a fundamental anchor point in that it provides confidence for our Shuttle customers, and a firm business planning base for potential Expendable Launch Vehicle privatization endeavors. Therefore, I am confident that the STS, with all its past investment and promise for the future, can go forward, and that private launch vehicle ventures can also flourish where they can best fill a market need or complement the Shuttle.

Mr. Beggs, in his earlier testimony to this subcommittee on May 3, 1983 stated: "We must, however, proceed with caution as we enter this relatively new arena. Although I wholeheartedly believe that the time has come to encourage and support expansion of commercial involvement in space activities, it is imperative that we develop sound guidelines by which this expansion takes place." I fully support the thrust of Mr. Beggs' statement and will enthusiastically support the Agency's efforts to establish those guidelines and, at the same time, insure that every reasonable approach proposed by the private sector is provided adequate consideration and opportunity.

Mr. Chairman, we intend to continue our efforts to increase the involvement of the U.S. private sector in civil space activities with a view for the national economic benefit and to fully exploit the capabilities of the STS. I will be pleased to respond to your questions.

Mr. VOLKMER. Thank you very much, General.

We will proceed with questions at this time. I now recognize the gentleman from Texas, Mr. Andrews. Five minutes.

Mr. ANDREWS. I don't have any questions, Mr. Chairman.

Mr. VOLKMER. Mr. Nelson from Florida.

Mr. NELSON. Thank you, Mr. Chairman.

General, it's good to see you. The President yesterday made the announcement that he was moving to commercialize ELV's.

Question No. 1: How does that confirm the pricing policy for the shuttle and how does it assure that it's going to be a maintained pricing policy?

General ABRAHAMSON: Mr. Nelson, in the policy also as stated on——

Mr. VOLKMER. Page 2.

General ABRAHAMSON. Page 2, thank you.

Mr. VOLKMER. Next to the last paragraph.

General ABRAHAMSON. I'd like to quote that. This was, in fact, an area of major discussion and we felt that it was, indeed, important as I commented in my testimony that this be established very firmly. Therefore, the statement that the U.S. Government will continue to make the space shuttle available for all authorized users, domestic and foreign, commercial and governmental, subject to U.S. Government needs and priorities and through 1988 the price for the STS flights will be maintained in accordance with currently established NASA pricing policies. Those pricing policies were established through 1988, primarily, because that was about as far as we could reasonably see into the future and it was also in the time frame that customers were coming to us and doing their planning, primarily for communications satellite.

Mr. NELSON. OK, now, that is with regard to the price of the shuttle.

General ABRAHAMSON. Yes, sir.

Mr. NELSON. Does this imply that you will keep the price—that you will require the commercial owners of the new ELVs to have a price that is the same as the equivalent payload price of the shuttle?

General ABRAHAMSON. Oh, no, sir.

Mr. NELSON. It does not?

General ABRAHAMSON. No. We really feel that has to be a——

Mr. NELSON. That's a market decision for them to make.

General ABRAHAMSON. Yes, sir.

Mr. NELSON. All right, then, how can you say that this policy establishes a clear—all right, then, I was reading into your statement, on page 4, something more than you said. I thought you were saying here that you were satisfied as to the question of the competition with the shuttle, but you're not.

General ABRAHAMSON. No, I am sir—in this way. Any enterprise has to, of course, have a proper return; and, indeed, the shuttle itself has to enter into a full cost-recovery period at some appropriate point. We think that that point is after the 1988 pricing period, and that's our objective, of course, to work to that. By the same token, any private commercial endeavor, trying to make a long-term effort by a Titan, a Delta, or any other kind of a vehicle to be a commercially viable enterprise, also has certain economic facts that it has to live with. That private commercial endeavor has to make a profit and has to make a return on its investment, and it certainly has to cover their costs. And those judgments should be theirs, in my judgment. We have established an appropriate U.S. Government pricing policy that we think is fitted to the market but, more importantly, is also fitted to the U.S. Government needs. The way it was established in the 1986 through 1988 time frame is that we first calculated and said that we believe that, in order to have a shuttle capability to meet the needs of the U.S. Government, that was a basic capability and that was given. Over and above that, if we had added capability to provide for commercial enterprises, they should pay for themselves. The pricing was established to do that so, with that kind of a pricing policy, and so long as that is not threatened, we think that that's stable. Our contracts that we have already written with customers will be honored and, in that sense, we think that's a good basis for going ahead.

Mr. NELSON. What is the period of time that you think that the shuttle as a transportation system will be most susceptible to losing payloads to commercial ELV's?

General ABRAHAMSON. Between now and 1988.

Mr. NELSON. And, thereafter, what do you see—that the commercial ELV's become a complement to the shuttle?

General ABRAHAMSON. I think that depends again on the market. My own view—and you have to recognize it may not be entirely objective—is that the shuttle offers so many more benefits to customers in the future that, indeed, the shuttle will be the primary launch vehicle as stated both in the policy and as stated by the President on the 4th of July. It will, indeed, serve not only to meet U.S. Government needs but it will serve as a technology driver for commercial applications in space as well; therefore, I feel that, indeed, the shuttle will be primary. Now, there may be areas where a more specialized vehicle can stand the test of the market over a period of time and survive. If they have the solid base planning of a shuttle program and they know that it's going to be there, they have an advantage that other commercial enterprises don't always have, by the way.

When Proctor & Gamble starts out for a new laundry product, they don't know what one of the other laundry companies is going to set up as their price, so that's an advantage to them.

On the other hand, so long as the U.S. Government maintains its commitment to the shuttle and makes the shuttle decisions in a separate context, then I feel confident that we will have a large and appropriate share of the market.

Mr. NELSON. In the time period between now and 1988 that you say we'll be most susceptible to losing payloads to commercial ELV's, how many do you estimate that we'll lose off the shuttle to ELV's?

General ABRAHAMSON. Well, not very many.

Mr. NELSON. What is that?

General ABRAHAMSON. I don't have a specific estimate. We spent a lot of time discussing that and there were estimates made.

Ike, would you like to comment on that, please?

Mr. GILLAM. We looked at what would happen if the shuttle lost one equivalent shuttle flight worth of payload, two equivalent shuttle flights worth of payload; but we did not do an estimate because we couldn't do a market forecast of which way the market might hop, so we did not do a precise estimate of how many we would lose.

Mr. **Nelson**. Did you do that estimate with regard to how many Ariane would lose?

Mr. **Gillam**. No. We didn't do it either way. We did it as to what would be the impact on the shuttle if it lost one equivalent shuttle flight, two equivalent shuttle flights, three equivalent shuttle flights and so on.

Mr. **Nelson**. Do any of you have an opinion with regard to Ariane with regard to how many it might lose?

General **Abrahamson**. To U.S. launch vehicles?

Mr. **Nelson**. To commercial ELV's, now that that is the policy.

General **Abrahamson**. That is a very difficult thing to obtain. Perhaps, it might be useful to look at the published Ariane flight manifest between now and 1985. Obviously, this is subject to change and there are some that are double-booked. At this point, they have 11 payloads booked, which are clear European payloads and those represent Marecs, Telecom, the European Communications Satellite—things like that where the countries involved, which are sponsoring and or owners of those systems, and they have an obligation to, in fact, check the Ariane first. They don't necessarily have to buy but they have to at least evaluate the Ariane carefully. They have six payloads which are losses to the U.S. market. Those occurred quite early and they include Westar, Spacenet, Gstar—several of those companies. By the way, we have not had any recent losses. Those losses that occurred at the time that the space shuttle slipped its initial operational date. And, then they have eight which are on the manifest which represent either Intelsat or other international payloads, such as the Brazilian payload or Arabsat 1.

My judgment is that a U.S. ELV will have a difficult time working into that European market but the area that they and the shuttle will both compete in is the area of winning back the U. S. companies. And we are doing that now and doing it quite effectively. However, in the international area, that is an open question. Probably the biggest question is Intelsat.

Mr. **Nelson**. Mr. Chairman, if I may, I've got several other questions. I'll be happy to stop now and try to pick up later, but I do have a number of other questions involving security at launch since most of these commercial ELV's will go from my congressional district. I have a question as to the commitment, the enthusiasm for the fifth orbiter vis-a-vis this decision announced yesterday on commercial ELV's, et cetera.

So what is your pleasure.

Mr. **Volkmer**. Well, let's proceed with the other questions first and, if we have time, we'll get back.

Mr. Walker.

Mr. **Walker**. Thank you, Mr. Chairman.

In your statement, you talk about the fact that we need to establish commercialization guidelines.

General **Abrahamson**. Yes.

Mr. **Walker**. What can Congress best be doing at this point that will aid you in a fast-track establishment of such guidelines and assure that we get the job done of implementing the Executive order as quickly as possible?

General **Abrahamson**. I think that all of the agencies involved are committed to moving very quickly on that and probably the most important thing is to not throw any roadblocks in the way.

Mr. **Walker**. OK. What would be roadblocks, for example?

General **Abrahamson**. Well, frankly, I can't think of anything. I think the important thing is that all of the agencies that were represented in the working group are embarked on a fast track to make this happen. In fact, the policy that was released pointed out that we are really talking about the working group being on an interim basis for a period of time. That interim working group wants to get out of business as quickly as possible. I know the NASA people don't want to be involved with consideration of regulation, for example. So, I think the important thing is just to let this work group step back and go to work.

Mr. **Walker**. You gave a pretty good compendium of a number of commercialization efforts that are underway that NASA has been involved in.

Is the working group involving itself with some of those other issues in addition to the ELV?

General **Abrahamson**. No.

Mr. **Walker**. Is there any intention of moving ahead toward other kinds of commercialization activities beyond ELV's?

General **Abrahamson**. I think that the record has already shown that, in fact, we are very anxious to do that. If you go back, one of the real facilitators in terms of the commercialization effort for other than the ELV's was the NASA policy on the joint endeavor agreement. That policy was announced in 1979 and we have nine agreements that are now and others that are under active consideration. I think we are moving ahead very aggressively in that area.

Mr. **Walker**. Well, what I was referring to specifically is: in your testimony, you talk about the whole process of regulatory changes, such as the existing license procedures that were involved with Conestoga 1.

General **Abrahamson**. Yes.

Mr. **Walker**. What I'm wondering is whether or not there is an effort underway to begin to move toward an executive order that would begin to spell out what major regulatory changes need to be made to make it less cumbersome for people to get involved.

Now, that may not be NASA's role. You say NASA wants to back away from that, but I would be hopeful that we would be moving toward a series of Executive orders aimed at commercializing a variety of sectors and not just limited to the ELV's and that's the basis for my question.

You made it quite clear that NASA has participated in the White House announcement. Can you give us any idea why the Department of State was chosen as the lead agency?

General **Abrahamson**. Yes.

First of all, the interim working group will be coming up with the streamlined procedures as quickly as possible. There is a joint chairmanship of that group, NASA and the State Department. The intent of that group was to, in fact, insure that the technical expertise is there, but that we also recognize the international requirement that our various treaties put on us; we think that that is a tougher nut to crack than some of the internal United States kinds of regulatory problems. Therefore, this was the rationale for setting both of these up as a joint chairmanship.

The point of contact role is one that says, during the time that this interim working group is, in fact, functioning and the final procedure is not published yet and the final responsibilities are not laid out, then the point of contact is to have a simple place so that anybody who wants to work this problem between now and that time doesn't have to do what the SSI people did, and that's go around to everybody that will, in fact, facilitate them.

By having the State Department as a participant in the working group, the working group can assist in that; so, it was intended to, No. 1 insure that there is no perception of a conflict of interest as NASA might represent, but to insure that we have a place where these people can go just during this interim period.

Mr. **Walker**. Well, my initial reaction certainly is that the State Department needs to be involved in that process. It's obvious that our international commitments, that is, our international treaties, play a major role in what we do. My question is, however, doesn't the State Department have a greater interest in making certain that every "t" is crossed and every "i" is dotted than pushing forward with commercialization? Wouldn't they tend to become a people standing with an intent of regulating rather than moving the commercialization process forward? And that's where my concern lies with establishing them as a lead agency. They don't have any particular mandate to push ahead commercialization. Was this considered before we made them the lead agency in something that's as important to our future as what we're deciding here?

General **Abrahamson**. Sir, I think that they do have a mandate. They have the mandate of the President of the United States who just signed out a policy. And, the only other point that I could make is that all of the people that worked on this working group were enthusiastic supporters.

And so I think that, to the extent that people make something happen—and that's really in the end the only way, it will happen. It will happen quickly and effectively.

Mr. **Walker**. I guess I've been around this town long enough to know that there are a number of people in the bureaucracies around town who have the feeling that Presidents come and go and Executive orders come and go but we're here forever. [Laughter.]

Mr. **Walker**. And they may or may not implement those things which are contained in the order.

Was any thought given and was there any projection as to the job potential which rests in the commercialization of ELV's?

Was there a study made as to how many additional jobs this might create? How many jobs might be kept? What the potential is for job development as a result of implementing this policy?

General **Abrahamson**. No; I don't believe that that was done in any serious or quantitative way.

Mr. **Walker**. That's all the questions I have. Thank you.

Mr. **Volkmer**. All right, then.

Mr. Lowery.

Mr. **Lowery**. Thank you, Mr. Chairman.

General, it's good to see you again.

I met with some journalists this morning on this policy and they put the question to me: Why should not the U.S. Government do the commercialization? And, with the $35 to $50 billion that we have sunk in space technology thus far—that the Government begin to capitalize upon that—make money and reduce the deficits, as opposed to brokering it out to the private sector.

What response would you have to that question?

General **Abrahamson**. To the extent that the space shuttle has a pricing policy and that pricing policy brings money back into the Treasury—and, for example, in 1984, we have some $264 million that we project will come back and, therefore, reduce the space shuttle budget by that amount, I think that that is indeed the case. So, to the extent that that's part of the space transportation system, then that does indeed bring back a return on that investment.

To the extent that the private companies pay taxes, that's a return on the investment, but there's another side to the equation: It costs money to operate these endeavors and, for the expendable launch vehicles, as an example, they are, indeed, getting to be a real burden at the low launch rates that we are talking about, so what we are doing, I believe, is that we are laying out a program for putting the shuttle there as a framework. We are saying that, if anybody can make a good business out of that, you are welcome to try. But, we don't want to keep putting out that expenditure and, to the extent that that expenditure at least avoids or obviates the cost, indeed that's——

Mr. **Lowery**. And, if we charge more for the ELV's, are you suggesting we would then no longer be competitive with, let's say, Ariane? For the Government, let's say, to charge more instead of the low amounts that they are charging for the services for launching.

If we were to keep that in-house and we charged more, would we then be competitive with Ariane, for instance?

General **Abrahamson**. I think that the Ariane competition is going to be a price competition at some point. Right now, it's reliability and schedule. But, at some point, it will become a price competition and the philosophy that we've used is that we think that the space shuttle indeed is the price leader, in a sense. We have set that price, certainly examining the Ariane cost but, nonetheless, we've said that Ariane—with the same economic pressures as everybody else—will set their pricing based on the shuttle, which they see as their primary competition. And, then the ELV problem is: how will they come out relative to both the shuttle and the Ariane?

Mr. **Lowery**. Well, I commend the administration for the policy which they have laid out for commercialization. I think it is the right way to go and I must say I gave basically the same answers you did as it relates to this: The Government will get theirs on the taxing end of it; the time has come to more thoroughly exploit this technology and our American economy is one of private sector competition.

I would agree NASA has done so well for so many years in research and development and has pushed us so far ahead in technology.

I want to see you continue with that as opposed to necessarily being the operator. I think that we've matured so the time has come to pass it along.

Considering that we've invested $35-50 billion in space infrastructure and technology,—three parts, Jim.

On what basis should we value any part of those assets that might be a candidate for transfer to the private sector?

Second, how would you suggest we insure a fair competition for the transfer of that asset? How do you suggest we guard against creating a monopoly in the private sector once we've taken those public assets and transferred them to the private sector?

General **Abrahamson**. Those are all very good questions—very appropriate and ones that were discussed very extensively in the working group as we looked at this.

If you'll notice, the policy allows a mixture of Government costing and fair market value, and I think that applies to different segments of the facilities and assets required to run one of these private businesses. Let's take the investment in the launching pads themselves and in the range-safety capability—that means the tracking capability—all those that go with that. That investment is a sunk cost. It's a multimillion-dollar cost over a very, very long period of time.

Mr. **Lowery**. I understand.

General **Abrahamson**. If we apply any industrial measure of writeoff to that, that's been sunk a long time ago. So, the fair market value, then, begins to become a key factor in the development of: "what should that cost be?" the way you do that is: you just try out several costs, either on a competitive basis or on what we think is appropriate and see if they'll be willing or able to pay for that.

The way we have tried to do is in a way that is somewhat equivalent to the shuttle. And I think that is very important when people raise the question of what is fair competition between the shuttle and these expendable launch vehicles. For example, in the pricing policy of the shuttle, at this point in time, we do not go back to try to recover the billions of dollars of R&D investment that went into the shuttle.

By the same token, we should not—and this is general agreement—go back and try to recover those kinds of investments in those facility items. Instead we ought to just try to base that on a fair market value, meaning reasonable return on the cost that these people can afford.

That may be a very different question for such things as the hardware associated with the extra Deltas or extra Titans that are left over. That question is one where those are high value items. They are expended each time and, in that case, we have to be very careful that we do not allow one company to be in a position of advantage because either they made the part or whatever to be able to buy these things at 5 cents on the dollar and then they become a get-rich-quick scheme for an individual.

I think the real intent of the policy is that this should be a long-term business where the ELV operators can make a long-term contribution to the Nation and they can, in that way, fit into the overall market in an important niche, again, hopefully complementary to the space shuttle. Therefore, you have to look at that very, very carefully and there are contractual schemes by which you can minimize their risk and the Government can recover a substantial amount of their money. But that depends on each or the contractual arrangements that the various departments and the agencies have for their ELV's.

Mr. Lowery. Who will be making those decisions?

General Abrahamson. The owners of the ELV's.

Mr. Lowery. From a Government standpoint in terms of the pricing policies?

General Abrahamson. In terms of the pricing policy NASA will make, we understand the guidance in the overall policy NASA will make that judgment in terms of the Delta; and, if there is more than one operator that wants to come and do that, we have an established procedure where we put out a request for information. If there are others who are, in fact, interested, then we can do this on a competitive basis.

Mr. Lowery. Do you see need for legislation, such as amendments to the Federal Property and Administration Services Act before we can do this transfer?

General Abrahamson. No, sir, I don't.

Mr. Lowery. You think everything should be done under executive policy?

General Abrahamson. I think that, at this point in time, we have well-established procurement regulations for all of the agencies that the people have confidence in and they know and understand and I think that should be the basis for the way in which we proceed.

Mr. Volkmer. Will the gentleman yield on that?

Mr. Lowery. I yield, Mr. Chairman.

Mr. Volkmer. You mentioned procurement practices.

General Abrahamson. Yes, sir.

Mr. Volkmer. Now, this is disposal.

General Abrahamson. Yes, sir.

Mr. Volkmer. It's a little bit different, isn't it?

General Abrahamson. Yes, sir, it is different but I believe, again, the practice goes beyond just procurement. As I indicated, NASA approaches such things as the joint endeavor agreements and some of our activities that do not involve the transfer of funds, that in that case what we have is a procedure which does insure that we treat people equitably. And that's the important element here.

So we avoid the monopoly question that Mr. Lowery raised. If we have only one interested agency or company that comes in and says that we want to operate a Delta off the Delta launch pad, then the arrangements that we have to make with that one company are pretty simple and fairly straight-forward and we establish a NASA priority or a Government priority for that particular system.

If, on the other hand, there are two companies, then we think the right way to handle that is to let each of them submit a proposal. Each proposal should be evaluated under a set of criteria that deals with such things as not only the price but how are they going to meet the needs of the customers and how is the Government going to be able to operate when it's the Government's turn to take over a priority mission and how will they, in fact, keep the facilities themselves in proper operating condition?

So there are a series of criteria that we can apply and should apply in order to insure, No. 1, that it's fair and, No. 2, that it's a reasonable return. The mistake would be to handle this under disposal kinds of criteria. And, we have sufficient authority to negotiate each of the agencies with these companies, so that we don't need to handle that only under disposal kinds of procedures.

Would you like to add to that?

Mr. **Gillam**. I might add with respect to FPA's, where appropriate procedures do not exist, there is a provision within the FPA's that allows us to apply for an exemption and to get an exemption to the property disposal regulations from the GSA.

Mr. **Lowery**. Are you quite convinced the State should be the lead agency?

It strikes me I have the same concerns Mr. Walker does. They should certainly be a part, particularly as interfacing with foreign governments and foreign companies, but here we are gearing up substantially through the Department of Commerce for trade and this strikes me as being another aspect of trade where we have technology and know-how and ability that other nations and foreign companies have interest in—that Commerce would be a more appropriate location within the Government to properly exploit the commercial value of space.

General **Abrahamson**. Remember this is only an interim working group. We are hoping that the length of time that that working group's efforts is measured in months, not in years—and, sir, I think you——

Mr. **Lowery**. You are more optimistic on how our Government runs than some of the rest of us.

General **Abrahamson**. Certainly, I think the Department of Commerce is an appropriate place and that will be very carefully evaluated by that working group.

Mr. **Lowery**. Could you amplify more on the working group—who are parties to it?

General **Abrahamson**. OK. I think we have several members who are indeed present.

Major Maultsby, would you like to stand up and comment on the DOD involvement, please?

Major **Maultsby**. It's represented by six agencies—the Department of Commerce, the Department of State, Department of Defense, Joint Chiefs of Staff, DCI; OMB and OSTP are observers.

Mr. **Nelson**. What is this—the senior agency group or what?

Major **Maultsby**. The working group.

Mr. **Nelson**. Excuse me. The working group?

Major **Maultsby**. The working group that was established reflects the SIG membership, yes, sir.

General **Abrahamson**. The point that I was making is that Major Maultsby is, in fact, one of the people who has been working on that particular working group. We have someone from my office—Mr. Charlie Gunn. We have a group of people who, in, fact, provided the basis of the policy.

Mr. LOWERY. Let me get that again. It's DoD, State, Commerce, NASA, OMB, Joint Chiefs of Staff——

Mr. GILLAM. DCI.

Mr. LOWERY. OST. Is that it?

General ABRAHAMSON. OMB is an observer.

Mr. LOWERY. OMB is an observer. Any other parties?

Mr. GILLAM. Commerce.

Mr. LOWERY. OK.

Mr. NELSON. Will the gentleman yield?

Mr. LOWERY. I yield.

Mr. NELSON. Is that group not cochaired by NASA and State?

General ABRAHAMSON. That's correct, sir.

Mr. NELSON. Then, the question I would have, as a follow-on is: why would not NASA be considered as to be the lead agency for the future, given the fact that NASA's role, for some period of time, has been to coordinate the launching of these commercial communications satellites?

I thank the gentleman for yielding.

Mr. LOWERY. Do you wish to respond? I have the feeling you don't want to.

General ABRAHAMSON. Sir, this is a working group. The intent is to get out of business quickly. And the real thrust of it is to find a streamlined method of operation and one of the very important issues is the problem in the State Department and how we, in fact, support our international commitments and do that in a way that is not going to be burdensome to these commercial people.

Since that's one of the main problems, we thought it was important, in fact, for the State Department to strap that on. So, in fact, that's part of the rationale for how the State Department was selected as a cochairman with NASA.

It's really not any more significant than that.

Mr. NELSON. Except that the State Department does not know often one hand from the other what it's doing. At least, NASA does.

Now, that's an editorial comment.

Mr. VOLKMER. The time for the gentleman from California has expired, Mr. Lowery.

Mr. LOWERY. Even with the "yields"?

Mr. VOLKMER. Yes. [Laughter.]

Mr. LOWERY. Shouldn't yield? OK, thank you, Mr. Chairman.

Mr. VOLKMER. I'll recognize now the gentleman from Virginia.

Mr. BATEMAN. Mr. Chairman, I can contain myself this afternoon, and I'll yield my time to the gentleman from Florida, Mr. Nelson, who has many questions.

Mr. NELSON. I thank you very much.

I have three questions. The first question is 1a and 1b. 1a: Is there any chance that NASA's pursuit of the fifth orbiter as a policy goal will be lessened as a result of commercial ELV's?

General ABRAHAMSON. I certainly hope not.

I don't believe that that was the intention here and, in fact, I think the important point in the statement that the shuttle would remain the primary launching system for all systems would indicate that that is not going to be the particular problem that we are all faced with. My own personal feeling is that the shuttle has to be the framework under which all of this is accomplished and the way that should be done. Then, No. 1, the pricing policy should be maintained; No. 2, that the decisions about the scope of the shuttle program and the robustness with which we support that should be independent decisions.

I believe that's the way it's been approached and I'm sure that it will be in the future. If that is the case, then the people who are coming in and want to move out on ELV's have to know that they are going to be working in the context of the shuttle program and look for how it is that they can contribute over and above the shuttle. In that sense, then they really be mutually self-reinforcing and help the U.S. space leadership. If it degenerates into one of these systems where the shuttle is underfunded, because of ELV's, then, in fact, I think that's a failure to support the investment that we have made over the years in the space program.

I don't believe that's anybody's intent.

Mr. NELSON. And I appreciate that response. And I certainly hope that isn't what is the consequence of this action because, early in your testimony, you were talking about how this commercial application could be compatible with the additional commercialization in the shuttle, and you cited electrophoresis, for example.

General ABRAHAMSON. Yes, sir.

Mr. NELSON. And, if one did become competitive to the other, we could be zapping the commercialization potential of the shuttle through an experiment such as electrophoresis. We must have an adequate orbiter fleet to service that kind of new emerging industry because only the shuttle can service it; the ELV cannot. So I hope you are correct there.

Second question: tell me about how you envision security at the launch site since you are using the Cape Canaveral Air Force Station for the primary location for these commercial ELV's.

General ABRAHAMSON. At this point in time, we don't see that the security problem is going to be any more complicated than it presently is, and, right now, it is complicated.

We do obviously right now have commercial companies and people operating from some of the same pads that we also have to maintain security. So we have procedures in place that we think we can extrapolate and work very well.

I just don't think that's a problem, Mr. Nelson.

Mr. NELSON. All right.

If some of my questions seem to imply a conclusion, let me tell you that I support your decision and the President's decision on commercialization of ELV's. And I just want to see that we are monitoring all of these potential problems very, very carefully.

Now, third, I have to ask this question: I was—and this does not directly bear on commercialization on ELV's but, if you want me to, Mr. Chairman, I can find some connection. [Laughter.]

Mr. NELSON. I was just informed, about an hour ago, that Mr. Beggs, Secretary Orr, and the Secretary of the Interior had just signed an agreement with regard to oil drilling in the Atlantic within your sphere of operations—yours and DOD's. I would appreciate it, since I have been one of the people who have been out-front on this protecting NASA's interests, if you could share with me any of the wisdom that you have as to how you can continue to drill for oil and have solid-rocket boosters dropping all around.

General ABRAHAMSON. Sir, since I'm in the same position that you are, in that I just recently heard about it, I am not privy to are whatever additional protection kinds of things are part of that agreement. Therefore, I just can't comment on it.

Mr. NELSON. All right, then, I would like to visit with you. And I understand Mr. Beggs is on his way out of town right now, but I'd like to visit with you.

Thank you, Mr. Chairman.

Mr. VOLKMER. The gentleman from California, Mr. Mineta.

Mr. MINETA. Thank you very much, Mr. Chairman.

General Abrahamson, I apologize for not having been here during the scope of your testimony. However, I'd like to ask: do you consider the launch vehicle offerings to Intelsat for Intelsat's six launches a competition between commercial entities and the U.S. Government?

General ABRAHAMSON. I consider that the primary competition is between the U.S. Government and the French Ariane. And I think that's the principal issue.

I do see that there is the potential for some competition between the Titan proposal and the space shuttle.

Mr. MINETA. And what would your reaction be if Intelsat chose ELV's for some or all of their launches?

General ABRAHAMSON. I'd be pretty disappointed in my own marketing efforts.

Mr. MINETA. How has NASA approached the question of relations with present suppliers on STS who also are offering ELV's?

General ABRAHAMSON. I think we've tried to just keep that quite separate from the activities just as companies often have several product lines. We haven't done anything about it in any particular way.

Mr. MINETA. And that delineation has been made?

General ABRAHAMSON. Yes, sir. I think yes, sir.

Mr. MINETA. I'm sorry?

General ABRAHAMSON. Yes, I think so. What's happening here is we are closing out the lines on the Delta and the DOD is closing out the lines on the Titan. And then the question is, of course, just how those may be extended if they are.

Mr. MINETA. No further questions, Mr. Chairman.

Mr. VOLKMER. I have some and then we'll recess.

I'd like to ask if you have any comments on Congressman Akaka's legislation.

General ABRAHAMSON. No, sir. I think that that does provide—in fact, facilitate—the one element that is not now established in the policy and that is to launch from other than the presently established launch site. I would point out that the policy, in fact, encourages coming from the U.S. Government launch sites, primarily because it's simpler, we believe.

Obviously, there may be some special advantages from some sides to some companies, depending on what their objective is. But, we think that the U.S. launch sites are well established. There are great advantages there and we are willing, in fact, to make those available.

Mr. **Volkmer**. I'd like to continue on with one of the first things that came about from the statements made yesterday by the White House on the commercialization. And the last sentence in that paragraph that you quoted from says beyond the period—1988—it is the U.S. Government's intent to establish a full cost recovery policy for commercial and foreign STS flight operations—1988 on. What impact does that policy have on competition with commercial ELV's?

General **Abrahamson**. Sir, that's been the objective that Mr. Beggs put out in front of me right from the very start. My responsibility is to get the cost down in such a way that we can be in a full cost-recovery kind of a position out there and still be competitive.

So that's the challenge that the space shuttle has.

Mr. **Volkmer**. Was that with four or five orbiters? Was it five?

General **Abrahamson**. Initially, back in 1972, when that was looked at under the initial cost studies, that was with five orbiters. Obviously, the fifth one has never been approved. Therefore, our job is to bring the cost down with the present fleet. That's what we have to do. I think we all are hoping that, in fact, the market as such will in fact support the procurement of a fifth orbiter, or maybe even more than that. As Mr. Beggs indicated, a fifth or a sixth at some point in time.

Mr. **Volkmer**. We do have a vote on but I would like to ask you one other question with regard to the inventory of ELV's that you are going to have on hand. Do you plan to dispose of those or hold those back for your own use?

General **Abrahamson**. That final decision is still yet to be made, sir, in terms of the Delta vehicle.

We expect the Scouts to go on for some period of time and NASA, by the way, is operating the Scout now primarily for Navy requirements—which is an example of one of the smaller vehicles that we think can and will and should, be a supplement to the space shuttle for a long period of time.

The termination of the Titan has already been announced by the Department of Defense.

Mr. **Volkmer**. Yes, but the inventories are not addressed in the statement put out by the White House.

General **Abrahamson**. They are addressed in the sense that what they indicate is that, for the inventories and for the other facilities that are required, we will look at a combination of Government cost-recovery and fair market value as we proceed with those various actions.

Mr. **Volkmer**. I recognize that disposition can be made of inventory, tooling, and other Government properties, and that leasing of the launch sites and setting-up operations for commercial vehicles with the military for safety, et cetera, can be worked out.

But, General, I think it would be a good policy by the administration and those involved to keep the members of Congress informed as to those policy decisions as they are made, so that later on there are no problems.

What do you think will happen in the event that we do go commercial and the competition is such that it is undercutting the shuttles. What's your position by 1988 going to be?

General **Abrahamson**. I guess I never considered that possibility, sir. I personally think that, in fact, the space shuttle is such a powerful vehicle with such unique capabilities for the future that there will not be the kind of a market that makes that happen.

Therefore, I guess I'm caught by surprise on your question and I'd like to submit an answer for the record.

[The information follows:]

I believe that the space shuttle will be able to compete effectively within the commercial arena. As the system matures and demonstrates its operational capabilities, its competitive advantages will become more apparent. At the same time, we will be working diligently to achieve the reduction in cost per flight that we have established as a baseline for the operation of the system. By 1988, we will have demonstrated fully the capabilities of the system, reduced per flight that we have established as a baseline for the operation of the system. By 1988, we will have demonstrated fully the capabilities and develop new ones. For these reasons, I believe that the space shuttle which is the primary launch system of the United states will be an extremely effective competitor in the market place.

Mr. **Lowery**. Mr. Chairman.

Mr. **Volkmer**. Yes.

Mr. **Lowery**. If I could respond. I used an analogy this morning that it was kind of like—in a high-tech sense the horse and buggy and the interim combustion engine and automobile.

We are in a time of transition right now between the shuttle and expendable launch vehicles but, eventually, the shuttle clearly will win out because of price considerations.

Once Henry Ford brought online that Model A, we didn't do away with the horse-and-buggy immediately, but for all practical purposes it did come in a reasonably short period of time.

I think we'll see the same thing happen with the shuttle, and ELV's.

Mr. **Volkmer**. Undoubtedly, in certain areas, there are certain people that don't believe that or else they wouldn't be interested in the commercialization of the ELV's.

General **Abrahamson**. That's their risk, sir.

Mr. **Volkmer**. I think you've agreed that we should have officially a single agency as a focal point for our commercial operators to be able to obtain licensing.

General **Abrahamson**. Yes, sir.

Mr. **Volkmer**. I'm not going to ask you what your preference would be. Let me ask you this: Once a technology has been commercialized through NASA through the R&D process, should the Government continue to fund the research in the area and, if so why?

General **Abrahamson**. Probably, the best example is the entire aeronautics program, sir. Had there not been an active NACA and additional Government research, we would still be back with airplanes that looked like the baling wire kind of airplanes that we used to have at the end of World War I, because people could not have afforded to have made the kind of investments that were required for supersonic airplanes, jet engines, and all those things. Those had to be a Government investment. So I think there are appropriate areas for investment that will continue.

On the other hand, the Government certainly should not be out building the 777 kind of a transport at this point in time. That's Boeing's job and McDonnell Douglas and the others.

Mr. Volkmer. In your opinion, what impact would there be on Government policy if U.S. companies who are in the commercial ELV business—after we get it off the ground floor and we get it going—are purchased by foreign countries?

General Volkmer. Again, because I think the shuttle should have enough capability to handle those kinds of things, I don't see that as a major problem.

Mr. Volkmer. All right. Thank you very much, General Abrahamson. That will conclude your testimony. We are going to have to leave and go vote.

We've got a total of eight votes, so it will be about an hour and you will be excused, and thank you very much.

And the time when we return will be about 3:50 to 3:55 and we will have Mr. Reynolds from the Department of Defense.

The subcommittee will be in recess, until after we vote.

[Whereupon, the subcommittee stood in recess for the purpose of voting.]

Mr. Volkmer. The subcommittee will come to order and we will proceed with the hearing.

We will now hear from Herbert A. Reynolds, Deputy Director of Intelligence and Space Policy, Department of Defense.

Mr. Reynolds, your statement, too, has been received and will be made a part of the record and you may either read it in full or summarize—however you so feel. You may proceed.

Mr. Reynolds. I'd like to read it, if you don't mind, sir.

Mr. Volkmer. I first want to thank you for waiting and apologize for the delay, but it's just one of those things.

STATEMENT OF HERBERT A. REYNOLDS, DEPUTY DIRECTOR, INTELLIGENCE AND SPACE POLICY: DEPUTY UNDER SECRETARY OF DEFENSE, POLICY

Mr. Reynolds. Mr. Chairman, I am pleased to have this opportunity to present the Defense Department views on space commercialization issues, and specifically on the commercialization of expendable launch vehicles.

I am accompanied today by Maj. Tom Maultsby from my office, who was cochairman of the interagency working group which studied the commercial ELV issue, and by Lt. Col. James Jacoby from Headquarters, Air Force.

If you have no objections, I intend to have both Colonel Jacoby and Major Maultsby respond directly to your questions should I feel that they can provide a more complete answer.

Mr. Volkmer. That will be agreeable.

Mr. Reynolds. During the past 18 months, the Department of Defense and all other departments and agencies concerned with our Nation's space programs have been involved in a series of space policy studies.

Three of the most important documents resulting from these efforts are the national space policy, the Department of Defense space policy and the policy on the commercialization of expendable launch vehicles which was signed by the President on May 16.

The national and defense space policies provide guidance for the conduct of the U.S. space program and related activities. The national policy recognizes the importance of private sector involvement in U.S. space activities.

Included in the listing of basic goals of the U.S. space program are a mandate to "* * * maintain U.S. space leadership—obtain economic and scientific benefit through the exploitation of space—and expand the U. S. private sector involvement in civil space and space-related activities."

The DOD approach to the proposed commercialization of expendable launch vehicles was, at all times, guided by the objectives I have just outlined.

Earlier this year, the President directed the senior interagency group to review the issue of the commercialization of expendable launch vehicles. An interagency working group including representatives from DOD, JCS, NASA, State, Commerce, OMB, DCI, ACDA, and OSTP was formed to conduct the study.

Based on the group's analysis, it was concluded that such an effort would be consistent with national policy and would yield considerable economic benefit to the United States.

This decision recognizes that commercial ELV operations could potentially reduce the shuttle mission model. The interagency evaluations, however, led to the conclusion that the potential impact on STS operating cost was not sufficient to warrant discouraging the proposed ELV commercialization by the U.S. private sector.

It was the group's unanimous conclusion that the U.S. Government should fully endorse and facilitate the commercialization of ELV's.

It was further agreed that U.S. Government should not subsidize this activity but should structure the agreements for us of its facilities, equipment and services consistent with the goal of encouraging viable commercial ELV launch activities.

The President's Commercial ELV policy reaffirms the existing U.S. Government commitment to the shuttle and the intent to make it available to all users—domestic and foreign, commercial and governmental—subject to U.S. Government needs and priorities.

We are fully committed to the shuttle and our program to transition all DOD payloads to the shuttle is well underway.

Within a few years, essentially all national security payloads will be shuttle-optimized and very few will remain compatible with ELV's. Based on this transition, steps have already been taken to discontinue future procurement of Titan launch vehicles.

Within the DOD, we believe that the shuttle will prove adequate for routine launch activities. We view the commercialization of ELV's as a potential means to maintain an expendable launch vehicle production and launch capability at little or no cost to the DOD that could contribute to the goal of achieving a more robust capability to place payloads in orbit.

While the immediate value of this capability to DOD is limited by the number of satellite programs compatible with the launch vehicles being marketed, it would at least provide a base from which an effective backup to the shuttle could be established if needed.

Another area where the commercialization of U.S. ELV's benefits the DOD is related to technology transfer. If U.S. commercial ELV's are not available and the satellite market expands beyond the capabilities of the STS and Ariane, a market for additional ELV's will be created. This market could be serviced in ways detrimental to our security. We must always remain aware of the fact that space launch systems have inherent military applications.

In addition to the direct benefits which would accrue to the DOD should a vigorous commercial launch capability be developed by the U.S. private sector, we believe that there are other benefits which provide strong incentives to support such an effort. These include enhancing the economy, creating jobs, expanding the tax base of the United States and a number of States and improving our international balance of payments.

Commercial ELV production and operations would maintain this segment of our high-technology industrial base and provide jobs for thousands of workers. Each launch conducted by a U.S.-produced ELV rather than the Ariane has been estimated to bring nearly $100 million of new business into the United States and thereby improve our international balance of payments.

Other commercial space ventures have already been started in conjunction with the space shuttle. These include private sector development of upper stages compatible with both the shuttle and ELV's and development of a satellite which leases services to individual payloads on request.

In our view, commercial ELV production and provision of launch services is an obvious and logical extension of this industrial activity. Further, a viable, high-technology space-launch industry could spawn numerous spinoffs and supporting activities and provide part of the base for U.S. dominance of what will undoubtedly become an even larger commercial space activity with favorable economic benefits to the people of the United States.

Although we would exercise it only in an emergency, the DOD has priority use of the shuttle. Any payload could be "bumped" to make way for a national security payload.

Commercial satellite manufacturers are concerned over the issue of priorities and other shuttle scheduling problems, and are expressing their concern by requiring that their payloads be "dual compatible". That is, the payload could be launched by an ELV or the shuttle. Without U.S. commercial ELV's, dual compatibility will mean the shuttle and the Ariane.

If a significant portion of this market for commercial satellite vehicles is lost to foreign competition, the direct and indirect cost to the U.S. economy could be measured in billions of dollars.

As the Government discontinues the procurement of ELV's, existing production and launch facilities will become available. These residual facilities and equipment will have little value to the U.S. Government but considerable value to a U.S. commercial ELV industry.

The sale or lease of these items would reduce agency budgets for production close-down and disposal of assets.

A considerable portion of our deliberations and subsequent interagency coordination activities were devoted to developing general pricing guidelines. It was concluded that any consideration for the use of U.S. Government facilities, equipment, and services should be based on the following general principles:

Cost recovery for services should be based on those additional costs incurred by the U.S. Government.

The U.S. Government will not seek to recover ELV design and development costs or investments associated with facilities to which the U.S. Government retains title.

Tooling, equipment, and residual ELV hardware costs will be priced on a basis that is in the best overall interest of the U.S. Government.

The President's policy on the commercialization of ELV's directs the formation of an interagency working group, cochaired by the Department of State and NASA to: Streamline the procedures used to implement existing licensing authority; develop and coordinate the requirements and process for the licensing, supervision and/or regulation application to commercial launch operations from commercial ranges, and recommend the appropriate lead agency within the U.S. Government to be responsible for commercial launch activities.

Until a final selection of the lead agency is made, the Department of State will serve as the interim U.S. focal point for all inquiries and requests relative to commercial ELV activities.

Until the final requirements are defined, the Government will continue to use the State Department's existing licensing authority for the regulation and authorization of commercial launches. Matters of flight safety and other technical issues will remain the responsibility of NASA, Defense, the FAA, and the FCC.

In summary, we support the President's policy on the commercialization of expendable launch vehicles by the U.S. private sector. The existence of such a capability will provide the basis for a more robust space launch capability and could support future developments to satisfy unique national security requirements.

National security could also be enhanced by having a backup launch capability for selected national security missions in the event of a generic problem that could ground the STS fleet.

There could also be national economic benefits resulting from domestic commercial exploitation and operation of U.S. Government-developed ELV capabilities, technologies, and systems.

Commercial launch operations could stimulate the U.S. economy and contribute to a more effective and flexible U.S. space launch capability which would contribute to maintaining U.S. leadership in space.

We are committed to the shuttle as the primary means for achieving access to space and do not believe that commercialization of ELV's will seriously affect the viability of the shuttle program.

We believe that the U.S. Government must support and encourage the U.S. private sector to compete for the multibillion dollar satellite payload and launch services market—or risk losing a portion of it to foreign competitors.

The U.S. private sector has indicated willingness to enter the commercial launch market on its own capital without Government subsidy. All they have requested is the opportunity to compete.

Their experience, expertise, and the excellence of their product should allow them to win a major share of the market that otherwise could be captured by the Ariane. We are firmly convinced that the commercialization of ELV's is in the best interests of the United States and recommend you support this activity.

Thank you, sir. I welcome your questions.

Mr. **Volkmer**. Thank you very much, Mr. Reynolds. And I will proceed. I have a few questions.

In the event the expendable launch vehicles are commercialized, what would be the base for pricing use of DOD services to the commercial ELV operators or owners?

Mr. **Reynolds**. The range cost will be additive cost to the range. What additional costs are, are incurred by the operation of that commercial ELV.

Mr. **Volkmer**. So, if I have a launch vehicle that I wish to place at one of your launch facilities at Cape Canaveral, then I would just pay you for the range services?

Mr. **Reynolds** [speaking to Major Maultsby]. Do you want to take that?

You will be responsible for the leasing of the launch facilities and then a share of the cost for operating the range—the additive cost.

The range and its facilities have to be there 365 days a year.

Mr. **Volkmer**. Yes.

Mr. **Reynolds**. What additive costs are there which are associated with that launch?

Mr. **Volkmer**. OK.

Mr. **Reynolds** [speaking to Major Maultsby]. Do you have anything else to add?

Major Maultsby. If I could amplify that iust a little bit for you, sir, we have some things that happen with each launch. You use a specific launch pad. We would lease that to the contractor that wanted to use it. There are other supporting facilities. We would lease those at whatever cost it was appropriate to do.

You need tracking capability for your launch vehicle and telemetry for the data that you produce on the vehicle to tell you how healthy it is. That kind of capability, we would sell to the contractors at the cost that was incurred, based on the number of manhours we spent, the amount of time we had the equipment in use and so on.

What we would not be doing on an additive cost basis would be burdening that with a percentage, if you will, of overhead costs to share the overall cost of operating the range because we have—this would be a relatively small part of our total business base there.

Mr. **Volkmer**. There would be no cost for the use of whatever type of launch facility?

Major Maultsby. As a physical facility. There would be no charge for that.

Colonel **Jacoby**. There would be a charge for the physical facility. The charge would not recoup the investment in the facility if you will. We've spent a number of millions of dollars to build our Titan launch pads for example. We would not try and recoup those costs.

The Government has gotten the benefit out of that that we built them for.

Mr. VOLKMER. But you have not told me you are going to let me go in there with a commercial, Titan-sized rocket to use that physical plant and set it up in there free of charge.

Colonel JACOBY. We would not do it free of charge. We would have a fee for that based on the very minimum—what it cost to operate the facility—so that there is no cost to the taxpayer for using that facility.

Mr. VOLKMER. And, in addition, there would be all the other things such as monitoring, safety, and all those things that are additional to the normal operational cost.

Colonel JACOBY. That's absolutely correct.

Mr. VOLKMER. Now, if the Titan launch vehicle is commercialized—and that's what we are looking at, how would you determine a value, first, let's say on the toolings that are presently owned by the Government? Do we have an answer to that yet?

Colonel JACOBY. We are still investigating precisely what approach we will take. What we are trying to do is consider the age of the tooling, its condition and most of it, in fact, would have little or no value to us if we were not continuing to build Titans and it would become scrap.

There are some pieces of equipment that are not unique to Titan production and they would be handled somewhat differently.

We already have provisions in the Defense Acquisition Regulations in terms of leasing Government equipment to contractors. We are looking at those and trying to calculate the cost that would be appropriate to lease that equipment and facilities to the contractors.

Mr. VOLKMER. Leasing instead of selling?

Colonel JACOBY. The final decision has not been made. I think, for the most part, we would probably find it more convenient or effective to lease that equipment.

That way, it would be available should the Government ever decide that we needed it again.

Mr. VOLKMER. OK.

Well, before I come up with the next question, you haven't come up with a value yet on the various types of equipment?

Colonel JACOBY. It turns out that the value is almost done on an equipment-by-equipment piece basis, based on its age and its original acquisition cost, much like we depreciate hardware for tax purposes.

Mr. VOLKER. What will be the basic procedure that you'll use? Will you advertise for bids on it or——

Colonel JACOBY. I wish I knew the answer to that question.

Mr. VOLKMER. You don't have that answer?

Colonel JACOBY. We are trying to decide that now. In fact, we have a team together trying to figure out just how we will handle each of the elements of activity.

Mr. VOLKMER. When it is done, would you be so kind as to inform us in writing of the decision?

Colonel JACOBY. We'd be glad to do that.

Mr. VOLKMER. What about the present inventory or the leftover inventory that you're going to have from Titan? Have you made a decision as to what to do with those yet?

Colonel **Jacoby**. We have not made a decision. We are trying to determine again what mechanism would be best to dispose of that—whether that equipment should be sold and, if so, at what price and what price we might be able to bring for it.

Mr. **Volkmer**. All right.

Again, I'd appreciate being advised of that decision.

Now, apart from the safety aspects and tracking, what other role do you envision playing in commercialization?

Colonel **Jacoby**. I think we want to try and minimize the part that we'd play. We would clearly have responsibilities for safety. And we would continue to do that, much as we do it today. It works quite well. We would have responsibilities for overseeing the Government facilities that we have been charged with. We would do that, as we do today, with leasing facilities which we do to a number of contractors for many, many purposes. And NASA does much the same thing.

And we have the responsibility for Government equipment, which we would be leasing and perhaps in some cases disposing of to the contractors.

We would again do that much as we do it today with excess equipment, with the same agencies that do it today.

Mr. **Volkmer**. Now, in the event of a commercial firm not using one of your facilities, do you envision yourself being implicated or involved in the launch in any way?

Colonel **Jacoby**. We do not.

Mr. **Volkmer**. In the event again that the Titan, let's say, is commercialized and the Scout and other vehicles that you use presently, would you contemplate, or does DOD contemplate continuing R&D on ELV's?

Mr. **Reynolds**. Not on specific ELV's. We will continue a research development and propulsion system, guidance systems, propellants—all those things which are related to advanced ELV's but we will not have a specific ELV development program.

Mr. **Volkmer**. Other than over in the Defense end, I'm sure we will. If we're talking about the MX or something like that, you are going to continue with that. That's out of your realm, right? Off the record.

Mr. **Reynolds**. Yes.

Mr. **Volkmer**. I'm sure, if Congress votes, we're going to continue that.

Now, you have a cutoff date, do you not, when you're going to discontinue using ELV's and start using nothing but the shuttle?

Mr. **Reynolds**. Yes, sir.

Mr. **Volkmer**. Can you tell me when?

Mr. **Reynolds**. That's programed, I believe, for—the last Titan launch is in—1986?

Colonel **Jacoby**. It varies depending on which launch site, sir. The last Titan launch on the east coast, which would be where the commercial operations would occur, is in 1985—fiscal year 1985.

Mr. **Volkmer**. When is your last launch at Vandenburg?

Colonel **Jacoby**. We have a backup to the first shuttle flight, in fact, to the second shuttle flight in January 1987 at Vandenburg at the present time. That may, or may not, fly. In fact, we would guess that it would not fly.

Our Atlas launches at Vandenburg will continue until about 1989.

Mr. VOLKMER. 1989?

Colonel JACOBY. Yes, sir.

Mr. VOLKMER. OK. I have no further questions. Well, Mr. Reynolds, it appears from your statement, at least as you summarize it, that you look upon the commercialization as definitely positive for not only the country but also DOD.

Mr. REYNOLDS. Yes, sir.

Mr. VOLKMER. As a backstop to the shuttle as a possibility and as competition to the Ariane but not as competition to the shuttle.

Mr. REYNOLDS. No; we didn't view it in the sense of competition to the shuttle.

We have all our eggs in the shuttle basket. Should there be a catastrophic problem with the shuttle, we still have urgent requirements and, if the line is shut down, we would have severe difficulty but, if the line is open for commercial purposes, it is possible that we could adapt those vehicles to satisfy some of our requirements.

Mr. VOLKMER. All right.

Do you have any objections—now, I'm not asking for approval, but objections—to the Department of Commerce or another one that I've heard talked about, the FAA, serving as the lead agency for commercial ELV's?

Mr. REYNOLDS. None at all.

What we have done is to appoint the State Department as the point of contact in this interim time period.

Mr. VOLKMER. I understand that.

Mr. REYNOLDS. Until we get this thing.

All the items that are new and different relate to State Department activities. All the matters pertaining to range safety and all these things—they are very standard and they are well thought out and they will not pose a problem.

The problems will come in relation to getting clearances for these activities—commercial activities from the State Department and we think that the study group will evaluate all the alternatives and their designation of a lead agency, so far as I know, probably will not be the State Department.

Mr. VOLKMER. Now, the study group has made a report, has it not, to the President?

Mr. REYNOLDS. Yes.

Mr. VOLKMER. Is that correct?

Mr. REYNOLDS. Not in that particular issue.

Mr. VOLKMER. No, I am not saying on that issue.

Mr. REYNOLDS. On the commercialization issue, we provided a report to the SIG. Space, yes.

Mr. VOLKMER. And they have it?

Mr. REYNOLDS. Yes.

Mr. VOLKMER. I was wondering: Do we have copies of those?

Mr. SMITH. No, we don't.

Mr. VOLKMER. I was just wondering if we can obtain copies of that report.

Mr. REYNOLDS. I don't believe there's any problem, sir.

Mr. VOLKMER. Pardon?

Mr. REYNOLDS. I don't believe there's any problem.

Mr. **Volkmer**. All right, because I'd like to have a copy just to review it and I'm sure it would probably be helpful to me to understand some of the problems that are involved with the State Department, other than the international problems.

Mr. **Reynolds**. It's releasable.

Its releasability will be determined by the NSC staff.

Mr. **Volkmer**. All right.

Mr. **Reynolds**. The work was done for them.

Mr. **Volkmer**. Well, I'll have my staff contact them.

Mr. **Reynolds**. And I will check it.

Mr. **Volkmer**. On the working group—on this SIG working group and how many people and agencies were represented? Your statement enumerates them?

Mr. **Reynolds**. Yes, sir.

Mr. **Volkmer**. Were they all represented by one person?

Mr. **Reynolds**. Not always. More than one on many occasions and particularly the DOD. We had somebody from DOD and we had Air Force people represented.

The DOD has designated the Air Force as executive agents for launch vehicles, so they were always interested in providing support to that activity.

Mr. **Volkmer**. So you had more than one on there from DOD then?

Mr. **Reynolds**. Yes.

Mr. **Volkmer**. Technically—from the military.

Mr. **Reynolds**. Yes.

There was no limit on support for that activity.

Mr. **Volkmer**. Can you tell us how many were on it from DOD?

Major **Maultsby**. We officially had only one representative from DOD.

The group called on the particular expertise we needed for the issues at hand. For instance, when we were dealing with the legal regime, we called on our general counsel people and provided that as backup.

Physically, each group only had one representative on it and we used that to contact whatever detailed information we needed.

Mr. **Volkmer**. OK, I see.

OK, thank you very much. I have no further questions, gentlemen.

Thank you very much, Mr. Reynolds; Major; Colonel. I appreciate it.

The subcommittee will stand adjourned.

[Whereupon, at 4:45 p.m., the subcommittee was adjourned.]

SPACE COMMERCIALIZATION

WEDNESDAY, MAY 18, 1983

House of Representatives,
Committee on Science and Technology,
Subcommittee on Space Science and Applications,
Washington, D.C.

The subcommittee met, pursuant to call, at 1:30 p.m., in room 2325, Rayburn House Office Building, Hon. Harold L. Volkmer (chairman of the subcommittee) presiding.

Mr. Volkmer. The subcommittee will come to order.

Today, the Subcommittee on Space Science and Applications is continuing with a series of hearings on the commercialization of space. The objective of this hearing is to acquire a knowledge of the major issues that concern the private sector in regard to the potential commercialization of space launch vehicles.

The United States has a stable of launch vehicles that is second to none. In addition to our range of proven and reliable expendable launch vehicles, the space shuttle has established a new national resource for scientific, national security, and civil applications. We have, therefore, a balanced set of alternative launch capabilities that we should consider maintaining, at least for the foreseeable future and in light of growing foreign competition. The private sector, with its proposals for operating ELV's, has demonstrated a willingness to cooperate with the Federal Government in preserving this balanced launch capability. It is, therefore, appropriate for us to study the issues surrounding the commercialization of launch vehicles at this time.

It is a pleasure to welcome out witnesses today who are all from the private sector and whose companies have each taken steps toward some private space venture. Our first witness is Mr. Gary Flora, Director of Commercial Titan at Martin Marietta. Mr. Flora is representing Mr. Teets who is unable to be with us today because of the snowstorm that hit Denver yesterday. Mr. Flora will be followed by Dr. Klaus Heiss, Founder of the Space Transportation Co., and Mr. Allan McArtor of Federal Express. Dr. Heiss has proposed the financing of a fifth orbiter using private sector funds and Federal Express, through its holdings in Spacetran, shares with Martin Marietta, an interest in the commercialization of the Titan launch vehicle.

Mr. William F. Rector III, is the next witness. Mr. Rector is vice president and director of space programs at General Dynamics' Convair Division where the Atlas-Centaur is produced. And our final witness today is Mr. James C. Bennett, vice president for Government affairs for ARC Technologies, a small company that is actively pursuing the development of its own launch vehicle. We are looking forward to hearing from all our witnesses.

Mr. Flora, you may proceed.

Mr. Teets' statement will be made a part of the record.

You may either summarize it or you may proceed and read it in total, however you wish.

STATEMENT OF GARY FLORA, DIRECTOR OF COMMERCIAL TITAN AT MARTIN MARIETTA, REPRESENTING PETER B. TEETS, VICE PRESIDENT AND GENERAL MANAGER, SPACE LAUNCH SYSTEMS DIVISION, MARTIN MARIETTA DENVER AEROSPACE

Mr. **Flora**. Thank you, Mr. Chairman.

First, I would like to extend Mr. Teets' apology. Denver was hit with a very unusual situation yesterday which we call a fluke of nature. Mr. Teets was unable to get to the airport in time for the few flights that did get out. As a result, I have been asked to meet with you today and to read highlights of his testimony.

Mr. **Volkmer**. You may proceed.

Mr. **Flora**. Martin Marietta Aerospace welcomes the opportunity to address this committee on the commercial development of space. We feel that a viable commercial U.S. space industry will yield important benefits for decades to come. Martin Marietta has already made commitments to foster the commercial space business and we applaud your efforts to encourage the private sector in this important national endeavor.

My comments today are organized into three parts. First, I will address the national benefits of a successful commercial space industry. Next, I will discuss the status of our efforts to produce and launch Titan vehicles on a commercial basis. Finally, I will review specific Government actions that will help stimulate an emerging commercial space industry.

A commercial space industry has national security value. Titan, in particular, can provide a backup capability to shuttle for certain national security payloads. Moreover, Titan can launch a satellite under conditions of international tension or conflict in which it would be undesirable to launch an orbiter.

We feel that expendable launch vehicles, especially Titan, complement the space shuttle. Titan will provide a backup capability to the shuttle for nonmilitary payloads in the event of schedule delays or priority DOD missions. Moreover, Titan will provide domestic supplementary launch capability during periods of peak civil and military demand, as well as launch capability for hazardous payloads and payloads that are neither technically nor economically feasible to upgrade to man-rated standards.

Since we are discussing the relationship between shuttle and Titan, I would like to digress momentarily to address the potential for shuttle and Titan competition. Let me assure you that Martin Marietta has no intention to allow commercial Titan vehicles to compete with the shuttle. We are pursuing the commercial Titan business because we believe both programs are mutually reinforcing and we believe that launch demand will exceed the shuttle capacity. Titan launches will compete for this excess demand which otherwise would be forfeited to the Ariane. There is no question that the shuttle is the dominant and most important U.S. launch system, but we are convinced that there will be at least one expendable launch vehicle coexisting in the world. The question is will we build Titan in America or will the French build Ariane in France. We estimate that there are approximately 6,000 jobs for 220 Titan suppliers in 25 States at stake on this question.

Martin Marietta's endeavors in commercial space have focused on two distinct product lines. They are the Titan expendable launch vehicle and orbital transfer vehicles. Today, I intend to limit my discussion to the Titan business venture.

The United States has been building Titans since 1955. Some 466 Titans have been built and 293 have flown. The Titan is indeed a mature launch vehicle. It has evolved through 10 distinct configurations, including the man-rated Gemini. The success record of Titan has been unparalleled by any other expendable launch vehicle. In the last 5 years, there have been 23 Titan III's launched and the success rate has been 100 percent. In the operational Titan III series, there have been 122 launch attempts and 119 successes—a 97.5 percent success rate. Today, the Titan has more payload capacity than any other expendable launch vehicle in the free world; some 31,000 pounds to low-Earth orbit.

Americans can be extremely proud of the performance of Titan over the last 28 years. However, the Air Force is phasing out the Titan program and the last Government-owned Titans are currently in production. As a result, last summer we took an indepth look at the market for commercial satellite launches and developed a conviction that the total launch demand will exceed the capabilities of the shuttle. The development of the Ariane expendable launch vehicle and its intended use by some American satellite firms has further reinforced this view.

Encouraged by the results of our market analysis, we decided to pursue the commercial launch vehicle business using the Titan vehicle. Our major associate contractors—the chemical systems division of United Technologies Corp. [UTC] and the Aerojet Liquid Rocket Co.—made a similar decision.

Since establishing a market base is critical to long-term success, the majority of the team's resources have been devoted to the preparation of a bid to the International Telecommunications Satellite Organization [Intelsat] for the launch of their Intelsat VI satellite series. Our proposal to Intelsat involves a bid for the launch of two satellites, designed to be a complement to the shuttle and a direct competitor to the Ariane. Production of the Titan vehicles will begin in 1983 and they will be available for launch in 1986. Our belief is that Intelstat will select the shuttle as well as one expendable launch vehicle to implement their total launch strategy.

Our marketing successes in the next few months will be crucial to our decision to move forward with this project. The success of our Intelsat bid plays a central role in that decision.

There should be no mistake about the uncertainties associated with this commercial space venture. The opportunity to successfully commercialize Titan will only exist for a limited number of months. If commercial contracts are not signed in the near future, then the Titan production line will be closed. Personnel will be reassigned and machinery will be dismantled. It will be extremely costly to regain these production capabilities. Moreover, the investment capital needed to support a commercial Titan venture will not be available unless there is some evidence of near-term sales. Delays in Government approval-support would be fatal to commercial Titan. Conversely, any action that the Congress can take to show support for the commercial space launch business would be extremely helpful. I will next review the status of Government actions in the last section of my testimony.

We are encouraged to hear that the President has approved a new space policy encouraging private sector entry into the expendable launch vehicle business. Our understanding is that the policy states clearly that the U.S. Government will encourage and facilitate the licensing and/or use to the private sector of those expendable launch vehicle systems that it previously operated. This support will include designs, tooling, ground support equipment, facilities and property that is being phased out. The policy states that Government will not seek to recover sunk costs. Moreover, the policy encourages and facilitates the use of national ranges by the private sector. We feel it is only reasonable for the Government to retain priority access to joint-use facilities, support services, and private sector ELV launch vehicles for national security or launch opportunity-critical missions. We believe that NASA and DOD should be encouraged to charge private sector ELV operators on an additive cost basis for joint use facilities and support services.

Private sector operators of ELV's must coordinate with the Department of State to assure compliance with applicable national and international laws and treaties. At the same time, ELV operators must meet all applicable security, safety, and environmental requirements and regulations. With regard to insurance, ELV operators will need to indemnify the USG, up to appropriate limits, again liability for damage/injury and will indemnify the USG against loss or damage to USG-owned equipment and facilities. On the other hand, ELV operators should expect that the USG would provide assistance to private sector ELV operators in any disputes concerning other nations. We do not believe that there is a need to establish any new agency, regulatory authority, or commission.

In your invitation to testify, Mr. Chairman, you asked for views on the Space Commerce Act proposed by Mr. Akaka—H.R. 1011. We applaud the motivation and direction of the Space Commerce Act. It encourages the private sector to pursue expendable launch vehicles as a business venture. In fact, the findings and purposes of the bill parallel today's discussion. A question, however, is whether additional legislation is necessary. Our legal staff has found that existing legislation appears adequate. The Air Force, for example has the authority to grant the use of Launch Complex-40 at the Eastern Test Range. In an approval-in-principal letter, Secretary Orr has acknowledged this fact. Nonetheless, he deferred final approval to us pending the ongoing executive branch review of commercial ELV's.

The Space Commerce Act seems to be focused primarily on institutional arrangement necessary for centralized control. It centralizes the entire licensing process to expedite the approval process. However, there are some issues that the act omits. The act does not direct DOD and NASA to allow private sector use of any Government launch facilities. Nor does it encourage the DOD and NASA to allow use of Government design and tooling without recapturing sunk development costs. Finally, there do not seem to be adequate safeguards that will prevent premature launch attempts without sufficient development and testing of the launch vehicle system.

This concludes my prepared remarks. We believe the United States would be well served by the development of a commercial space industry. The actions that the Government needs to take involve little or nothing in the form of budget outlays, but what actions are required must be taken quickly. The companies involved in commercial space technologies cannot afford long delays in Government policymaking or implementation. Production lines and key personnel involved will be lost if commercialization is not successful in the very near future.

Thank you very much for giving me the opportunity to testify before you today.

[The prepared statement of Mr. Teets follows:]

Statement
of
Mr. Peter B. Teets
Vice President and General Manager
Space Launch Systems Division
Martin Marietta Denver Aerospace

Mr. Chairman and Members of the Committee:

Martin Marietta Aerospace welcomes the opportunity to address this committee on the commercial development of space. We feel that a viable commercial United States space industry will yield important benefits for decades to come. Martin Marietta has already made commitments to foster the commercial space business and we applaud your efforts to encourage the private sector in this important national endeavor.

My comments today are organized into three parts. First, I will address the national benefits of a successful commercial space industry. Next I will discuss the status of our efforts to produce and launch Titan vehicles on a commercial basis. Finally, I will review specific government actions that will help stimulate an emerging commercial space industry.

National Benefits of a Successful Commercial Space Industry

The national benefits of a U. S. commercial space industry are numerous. The development of such an industry serves many of the federal government's stated policies. One theme of President Reagan's economic policy has been to improve the economy by reducing the role of government and emphasizing private sector initiatives. The development of a commercial space industry will directly help the economy. A proven lower cost alternative to foreign space launch systems will reduce imports and contribute to our balance of trade. Likewise, the acknowledged U. S. leadership in space technology will be enhanced by commercial launch capabilities without burdening the federal budget. These activities directly translate into increases in high-technology jobs with the usual multiplier effects on employment in other sectors of the economy.

A commercial space industry has national security value. Titan, in particular, can provide a backup capability to Shuttle for certain national security payloads. Moreover, Titan can launch a satellite under conditions of international tension or conflict in which it would be undesirable to launch an orbiter. Our national defense will be further served by the maintenance and expansion of the high technology industrial base. Mobilization of this base during times of conflict will be much faster if a commercial space industry is in place.

Another benefit of commercial Titan, in particular, will accrue directly to the Air Force. A commercial Titan business provides the potential for Air Force recoupment of its investment in residual Titan boosters and components. In addition, the commercial Titan business can be a consumer of residual Titan II propellants, thereby solving an environmental and safety problem facing the USAF.

We feel that expendable launch vehicles, especially Titan, complement the Space Shuttle. Titan will provide a back-up capability to the Shuttle for non-military payloads in the event of schedule delays or priority DoD missions. Moreover, Titan will provide domestic supplementary launch capability during periods of peak civil and military demand. As well as launch capability for hazardous payloads and payloads that are neither technically nor economically feasible to upgrade to man-rated standards. The economic viability of Shuttle will be enhanced by Titan through the provision of attractive launch backup for commercial users.

Since we are discussing the relationship between Shuttle and Titan, I would like to digress momentarily to address the potential for Shuttle and Titan competition. Let me assure you that Martin Marietta has no intention to allow commercial Titan vehicles to compete with the Shuttle. We are pursuing the commercial Titan business because we believe both programs are mutually reinforcing and we believe that launch demand will exceed the Shuttle capacity. Titan launches will compete for this excess demand which otherwise would be forfeited to the Ariane. There is no question that the Shuttle is the dominant and most important United States launch system, but we are convinced that there will be at least one expendable launch vehicle co-existing in the world. The question is will we build Titan in America or will the French build Ariane in France. We estimate that that there are approximately 6,000 jobs for 220 Titan suppliers in 25 states at stake on this question.

The benefits of a commercial space industry to the United States are large and diverse. Some might argue that these benefits could warrant a significant amount of government investment to stimulate the industry. However, we do not see the need for any government investment to commercialize Titan. What is needed is that no institutional barriers preclude our implementation. I will discuss some specifics on this subject in the last section of my testimony, but let me talk first about our commercial space activities.

Martin Marietta's Commercial Space Business Activities

Martin Marietta's endeavors in commercial space have focused on two distinct product lines. They are the Titan expendable launch vehicle and orbital transfer vehicles. Today, I intend to limit my discussion to the Titan business venture.

The United States has been building Titans since 1955. Some 466 Titans have been built and 293 have flown. The Titan is indeed a mature launch vehicle. It has evolved through ten distinct configurations, including the man-rated Gemini. The success record of Titan has been unparalleled by any other expendable launch vehicle. In the last 5 years, there have been 23 Titan IIIs launched and the success rate has been 100%. In the operational Titan III series, there have been 122 launch attempts and 119 successes - - a 97.5% success rate. Today, the Titan has more payload capacity than any other expendable launch vehicle in the free world; some 31,000 lbs. to low-earth orbit.

At the present time many American products are being criticized for lack of quality. That is clearly not the case with Titan. Americans can be extremely proud of the performance of Titan over the last 28 years. However, the Air Force is phasing out the Titan program and the last government-owned Titans are currently in production. As a result, last summer we took an in-depth look at the market for commercial satellite launches and developed a conviction that the total launch demand will exceed the capabilities of the Shuttle. The development of the Ariane expendable launch vehicle and its intended use by some American satellite firms has further reinforced this view.

Encouraged by the results of our market analysis, we decided to pursue the commercial launch vehicle business using the Titan vehicle. Our major associate contractors - - the Chemical Systems Division of United Technologies Corporation (UTC) and the Aerojet Liquid Rocket Company - - made a similar decision. In October, 1982, all three companies signed a memorandum of intent with the Space Transportation Company, Inc. (SpaceTran) to act as our agent for commercial Titan sales. Since then, the Titan team of SpaceTran, Martin Marietta, UTC and Aerojet have worked together to establish this business.

Since establishing a market base is critical to long term success, the majority of the team's resources have been devoted to the preparation of a bid to the International Telecommunications Satellite Organization (INTELSAT) for the launch of their INTELSAT VI satellite series. Our proposal to INTELSAT involves a bid for the launch of two satellites, designed to be a complement to the Shuttle and a direct competitor to the Ariane. Production of the Titan vehicles will begin in 1983 and they will be available for launch in 1986. Our belief is that INTELSAT will select the Shuttle as well as one expendable launch vehicle to implement their total launch strategy.

INTELSAT received bids from NASA, Ariane, General Dynamics and SpaceTran. A final decision by INTELSAT is expected in June, and we are confident that the technical merits and performance record of Titan will weigh heavily in our favor.

The financial commitments of the Titan team have been substantial. Significantly larger financial hurdles remain ahead. Funds will be needed for the development/modification effort and for actual production of the vehicles. Our marketing successes in the next few months will be crucial to our decision to move forward with this project. The success of our INTELSAT bid plays a central role in that decision.

There should be no mistake about the uncertainties associated with this commercial space venture. The opportunity to successfully commercialize Titan will only exist for a limited number of months. If commercial contracts are not signed in the near future, then the Titan production line will be closed. Personnel will be reassigned and machinery will be dismantled. It will be extremely costly to regain these production capabilities. Moreover, the investment capital needed to support a commercial Titan venture will not be available unless there is some evidence of near-term sales. Delays in government approval/support would be fatal to commercial Titan. Conversely, any action that the Congress can take to show support for the commercial space launch business would be extremely helpful. I will next review the status of Government actions in the last section of my testimony.

Government Actions

We are encouraged to hear that the President has approved a new Space Policy encouraging private sector entry into the expendable launch vehicle business. Our understanding is that the policy states clearly that the U. S. Government will encourage and facilitate the licensing and/or use to the private sector of those expendable launch vehicle systems that it previously operated. This support will include designs, tooling, ground support equipment, facilities and property that is being phased out. The policy states that government will not seek to recover sunk costs. Moreover, the policy encourages and facilitates the use of national ranges by the private sector. We feel it is only reasonable for the government to retain priority access to joint-use facilities, support services, and private sector ELV launch vehicles for national security or launch opportunity-critical missions. We believe that NASA and DoD should be encouraged to charge private sector ELV operators on an additive cost basis for joint use facilities and support services.

Private sector operators of ELVs must coordinate with the Department of State to assure compliance with applicable national and international laws and treaties. At the same time, ELV operators must meet all applicable security, safety and environmental requirements and regulations. With regard to insurance, ELV operators will need to indemnify the USG, up to appropriate limits, against liability for damage/injury and will indemnify the USG against loss or damage to USG owned equipment and facilities. On the other hand, ELV operators should expect that the USG would provide assistance to private sector ELV operators in any disputes concerning other nations.We do not believe that there is a need to establish any new agency, regulatory authority, or commission.

In your invitation to testify, Mr. Chairman, you asked for views on The "Space Commerce Act" proposed by Mr. Akaka (HR 1011). We applaud the motivation and direction of the Space Commerce Act.It encourages the private sector to pursue expendable launch vehicles as a business venture. In fact, the findings and purposes of the bill parallel today's discussion. A question, however, is whether additional legislation is necessary. Our legal staff has found that existing legislation appears adequate. The Air Force, for example, has the authority to grant the use of Launch Complex-40 at the Eastern Test Range. In an approval in principal letter, Secretary Orr has acknowledged this fact. Nonetheless, he deferred final approval to us pending the on-going executive branch review of commercial ELVs.

The Space Commerce Act seems to be focused primarily on institutional arrangements necessary for centralized control. It centralizes the entire licensing process to expedite the approval process. However, there are some issues that the Act omits. The Act does not direct DoD and NASA to allow private sector use of any government launch facilities. Nor does it encourage the DoD and NASA to allow use of government design and tooling without recapturing sunk development costs. Finally, there do not seem to be adequate safeguards that will prevent premature launch attempts without sufficient development and testing of the launch vehicle system.

This concludes my prepared remarks. We believe the United States would be well served by the development of a commercial space industry. The actions that the government needs to take involve little or nothing in the form of budget outlays, but what actions are required must be taken quickly. The companies involved in commercial space technologies cannot afford long delays in government policy-making or implementation. Production lines and key personnel involved will be lost if commercialization is not successful in the very near future.

Thank you very much for giving me the opportunity to testify before you today.

Mr. VOLKMER. Thank you very much, Mr. Flora.

I would like to know if you are prepared to answer questions?

Mr. FLORA. Yes.

Mr. VOLKMER. All right.

Now, we have within the Government, of course, with the Titan and other dispensable vehicles, the infrastructure, tooling, design work, and so forth, built up over the years.

Now, if it is turned over on a commercial basis, do you have an opinion as to what basis should be the value of those assets that the Government presently has?

Mr. FLORA. We at Martin Marietta, Aerojet, Delco, and other suppliers, have been working with the Air Force with formulas they have developed on the values of those hardwares and facilities, under the aspects of acquisition costs, and have been working depreciation formulas with them.

So it is a negotiation process that we are currently involved with with the U.S. Air Force.

Mr. VOLKMER. When does the Air Force plan to, if you know, shut down the Titan line?

Mr. FLORA. The Air Force has already made known they plan to stop the building of the 34-D Titan vehicle. They cancelled the last two vehicles we called 15 and 16. So they are starting in June of this year to begin this transition to no production, which is over a 2-year timeframe from production to no production.

Mr. VOLKMER. You said in your statement that the opportunity to commercialize Titan will only exist for a limited number of months. When do you anticipate that a decision will have to be made as to whether or not the Titan will be commercialized?

Mr. FLORA. That is a crucial question. We are involved currently in a proposal to the Intelsat people. They have a board meeting in June. Our proposal went in May 11, with FEDEX-Spacetran. And in that, the prerequisite by the middle of June was that we have indication that the Government will, in fact, allow the building and launching of the Titan vehicle by commercial venture.

So it is very near term. Certainly, the President's policy does help that.

Mr. VOLKMER. Let's assume that the Government goes ahead and says they will. But will you, if you are not successful with Intelsat VI?

Mr. FLORA. We will have to then review the market that is available and look at why we lost Intelsat VI, what were the factors, and revisit that decision, if we are not successul with Intelsat VI.

Mr. VOLKMER. In other words, Intelsat VI is not necessarily the trigger mechanism.

Mr. FLORA. No. But it certainly is a positive sign. This is our first competition with Ariane.

Mr. VOLKMER. If you were successful, would it mean that you would proceed?

Mr. FLORA. Certainly.

Mr. VOLKMER. You mention here in your statement, on the question of insurance, hold harmless to the Government. Do you feel that you would also have your own insurance or that the companies involved would hold harmless to the Government on the launch?

Mr. FLORA. Yes; we do plan to have proper insurance coverage that the Government will require of you to protect from damage.

Mr. VOLKMER. Now, the other thing that I would like to know a little more about is why you think the launch vehicle that you are proposing using Titan as a base would not compete with the space shuttle.

Mr. FLORA. Yes. As we looked at the satellite market that was out there, much to our surprise we found that there are satellite companies out there that are not ready to put their very expensive satellites on only one launch system.

I think the Intelsat is a prime example. They are now talking about obviously using shuttle and an expendable to complement shuttle. The basis of our strategy is to offer the same lower Earth orbit capability in terms of upper stages that the shuttle offers for that satellite.

If the satellite owner then is interested in two launch systems, because he does want a backup, the Titan essentially would fly the same weight the shuttle would be flying. The shuttle would be the prime vehicle. That is why we complement shuttle and not really compete with it.

Mr. VOLKMER. On the other hand, if the XXZ company has a contract with NASA for the shuttle, and they have a backup with you or Ariane, but they go with the shuttle, that means you don't go or Ariane doesn't go.

Mr. FLORA. That is a market risk. Certainly we will have to see how many of those we can book and what the dollar value would be for being a backup to shuttle. That has to be part of the market strategy, sir.

Mr. VOLKMER. Somewhere along the line you are going to have to require some earnest money, as the saying goes, from those people who wish to sign up.

Mr. FLORA. Precisely.

Mr. VOLKMER. Now, if the Titan is commercialized, and let's say you are successful, what role would you expect the Department of Defense to play in launch activities?

Mr. FLORA. The way we envision that now, and we have been working with the range people at ETR, or Cape Canaveral Air Force Station, the Air Force would be the host for the launch facility, because they will still be in there with some payload operations in some of the buildings. They would be the host. We would be the tenant.

And we would provide the maintenance that we agreed to with the range. And then the Air Force would involve them with the launch activity, things like range safety, the range safety officer, approval of our flight plans, destruct systems required, and so forth, the data stream coming back during the launch, those things would be worked out with the Air Force.

Mr. VOLKMER. As I understand from testimony yesterday from the Air Force, they would charge you not for the amortization costs, on the cost of the launch site, but basically add-on, additional expenses incurred, because of your launch. Is that your understanding?

Mr. FLORA. That has been our understanding to date, sir, yes.

Mr. **Volkmer**. Do you anticipate NASA playing any part in the commercialization venture?

Mr. **Flora**. We have had some discussions with NASA people regarding the use of some payload test facilities that would be offered on the NASA side of the range there. I would say the NASA involvement would be fairly minimal at this time depending on if we need some of those facilities.

Mr. **Volkmer**. You anticipate that DOD would do the tracking, and so forth.

Mr. **Flora**. Yes, through the range. That is a part of our requirements that we would negotiate with the Air Force.

Mr. **Volkmer**. My final question is, you commented on Congressman Akaka's bill. Do you have an opinion as to whether or not we need a central or focal point in the commercialization of expendable launch vehicles or licensing the operation of commercial launch vehicles, whether it be State Department or Commerce or anyone else?

Do you feel there should be a central place?

Mr. **Flora**. We are quite willing to work with any and all agencies, obviously, to get on with it. We like the idea of a central agency that is economic in terms of time and having one interface that can provide the wherewithal. So we do support a central agency, wherever that might be located.

Mr. **Volkmer**. You have had considerable relationships with NASA—there is no question about that—in the past. However, on commercialization, it is something new.

In regard to the last question, also, do you feel that NASA should have a commercial sector within NASA?

Mr. **Flora**. That is an interesting question. I think that if NASA had such an office or commercial sector activity, our strategy in supporting the shuttle in terms of peak demand periods of satellites, that perhaps they cannot launch for whatever reason, a NASA office could be very helpful to at least the commercial Titan activity in interfacing with those people and finding out what satellites are available that may come through NASA.

Yes, that could be helpful.

Mr. **Volkmer**. Thank you very much, Mr. Flora.

I now recognize the gentleman from Florida, Mr. Nelson.

Mr. **Nelson**. Thank you, Mr. Chairman.

Let me compliment you, Mr. Chairman. I think you asked a number of very excellent questions. Let me parenthetically say right here in the way of an announcement, that since we are talking about matters that if this venture does proceed, commercializing ELV's, and the launching as has been described with the range safety being provided by the Air Force and so forth, as of this very day NASA supposedly has agreed to allow the drilling of oil off the east coast and in the sphere where the launch will be made.

My position is, which I think is NASA's real position, is that they don't want that drilling.

And as far as I know, we still have language in the Interior Appropriations bill, which is going to markup this afternoon at 3 o'clock, that will prohibit for the remainder of fiscal year 1983 any lease sale occurring on July 26.

First of all, Mr. Flora, I would like to ask you to explain a little bit more about how you see that commercialized ELVs would not compete with the shuttle.

Specifically, why would that not delay any commitment toward a fifth orbiter?

Mr. **Flora**. Well, if the U.S. Government goes ahead with the fifth orbiter, I think our strategy has to be reexamined as we go. The mission model that we examined was under the assumption there would be no fifth orbiter, and we looked at the satellite demand in the 1986, 1987, 1988 timeframe, which is what we are operating under right now, and made the assessment I shared with you earlier.

Mr. **Nelson**. Did you make that assumption there would be no fifth orbiter?

Mr. **Flora**. Based on what we are learning, of what is happening in Washington.

Mr. **Nelson**. Are you aware in the NASA authorization bill there is $50 million to keep alive the production line on the fifth orbiter.

Mr. **Flora**. Yes, I am aware.

Mr. **Nelson**. And it is still your conclusion there will be no fifth orbiter?

Mr. **Flora**. Not in the near 1986-87 timeframe. That was our conclusion, yes.

Mr. **Nelson**. What about by 1988?

Mr. **Flora**. I could testify one year from now and talk to you about it; 1986 and 1987 was our first thrust certainly with the Intelsat proposal. We did direct our analysis on those 2 years.

Mr. **Nelson**. Only those 2 years?

Mr. **Flora**. Along with the model of 1988. The 3 years.

Mr. **Nelson**. What kind of business do you think that you would take away from Ariane?

Mr. **Flora**. That is an intriguing question. We would like to take every satellite we can away from Ariane. And that is a rhetorical remark. Our goal is to launch four Titans a year. That is our market goal, to stay viable and be competitive.

And so may I say that we would like to take four Ariane flights away a year.

Mr. **Nelson**. What is the probability that would occur?

Mr. **Flora**. Again, as I said earlier in my testimony, looking at the number of commercial satellites that are in the 1986, 1987, 1988 timeframe that are currently not booked on shuttle nor booked immediately on Ariane, and using even a 60- or 50-percent factor of viability of that satellite—are they cutting chips yet, designed, proposing a slot—we feel there is an opportunity for four Titans a year in those years.

Mr. **Nelson**. There are a lot of other commercial expendables—Atlas, Centaur, Delta. How is it that you feel confident that Titan will work into being a viable commercial vehicle?

Mr. **Flora**. Well, the first is that we do feel we offer a range of satellite capability because of the total performance of the Titan vehicle. Our vehicle today can fly the Intelsat VI, as we have it today. We can fly multiple satellites of the smaller classes.

So we feel the Titan can offer a greater range of services and if we can get in with the Intelsat VI bid on the ground floor, that will make us viable for the other alternatives.

Mr. Nelson. Let's say we are looking at 1988-89. Shuttle has a certain pricing policy. We were told yesterday by General Abrahamson that shuttle is going to have a stable pricing policy through 1988. By 1987 and 1988, would your price on an equivalent load be as much or less than the shuttle price?

Mr. Flora. I cannot really answer what that shuttle price will be then. Certainly we are not competitive now with shuttle prices for two reasons.

First off, the price we offer Intelsat is not as competitive as the shuttle offered.

Second, we carry about half of a shuttle payload in one of our launches—two Titan launches are worth one shuttle launch. We are not competitive.

I cannot speak to what will happen in 1988 and 1989.

Mr. Nelson. Why would people fly on your vehicle as opposed to shuttle?

Mr. Flora. Only because they cannot book a ride on shuttle. They won't be able to carry all the satellites we see there.

Mr. Nelson. That would be the case if there were no fifth orbiter?

Mr. Flora. Certainly, that would jeopardize—if there is not a fifth orbiter, there will be more satellites to fly, yes.

Mr. Nelson. Does not Martin Marietta have a conflict of interest here? You build the Titan, and yet you build also the external tank on the shuttle.

Mr. Flora. Precisely. We are NASA's No. 2 contractor on the shuttle. As you know, we build the tank and are involved in the shuttle activity at Vandenberg and several minor roles on the orbiters themselves, electronic hardware.

We think there is room for an expendable and the shuttle, and that they complement each other. We think there is a need for an expendable, and there may be times when this Nation may want to use that expendable, and the Titan in being will essentially give the Nation that expendable without any real investment by the Nation, if we are allowed to compete in the marketplace.

Mr. Mineta. Will the gentleman yield?

I just wonder if the conflict is with Martin Marietta or with NASA. As a supplier on the STS, are you getting any other kinds of pressures from NASA, subtle or otherwise, because you are on both ends—ELV as well as on the STS? Are you getting any kind of subtle pressures, or maybe not so subtle pressures to persuade you to curtail your commercial ELV pursuits, given the fact that you are also dealing on the STS?

Mr. Flora. No, because Martin Marietta does feel the two complement each other and we have had discussions with Mr. Beggs and General Abrahamson at very high levels, and safe to say Martin Marietta would not be here today or would not have submitted a bid to Intelsat if we said otherwise.

No, we don't see those pressures.

Mr. MINETA. Your statement says you feel that it is complementary and it is not competitive. I wonder if you could really expand on that.

Mr. FLORA. Well, again, we see the marketplace as allowing an expendable to coexist with shuttle because of the number of satellites that we see out there that want to fly.

Second, we are trying to offer a service that complements the shuttle capability, and in addition, something I have not mentioned as part of our commercial Titan is to create a 14-foot payload carrying capability which we think will encourage the satellite community to bigger diameters, putting more on shuttle.

There is not that big a diameter alternative on an expendable launch vehicle. So we are offering a 14-foot payload also.

Mr. MINETA. I thank my colleague.

Mr. NELSON. Thank you, Mr. Chairman.

Mr. MINETA. The gentleman from Virginia, Mr. Bateman.

Mr. BATEMAN. Thank you, Mr. Chairman.

I apologize for having come in late and just perusing your statement as you were responding to others.

But I was intrigued by your references in your prepared statement to Titan having a backup capability to shuttle for certain national security payloads. Can you elaborate on that?

Mr. FLORA. In this framework I think the best way to say that is the fact that Titan currently flies a large number of DOD satellites. That is the vehicle we are proposing to use for our commercial activity.

Therefore, some of those satellites could still fly on that Titan vehicle, with the proper Air Force overview.

Mr. BATEMAN. I, being something of a novice at this, perhaps assumed too much. I assumed that was within the existing parameters of how things get done, and has no immediate direct implications in terms of commercialization. Or are you thinking of some new methodology or institutional approach to taking care of that mission for the Department of Defense?

Mr. FLORA. No. What we are simply saying is, with the advent of a commercial Titan, the launch, the launch team, and the facilities will all stay in place, the costs borne by the private sector.

At some future time, if the Air Force or DOD needed that vehicle for any purpose, including satellites they fly today, for whatever reason, it would be in place.

Mr. BATEMAN. On page 3 of your testimony you have some figures with reference to the number of Titans built since 1955 and the number which have flown.

The difference between the two numbers is 173. Should I take it to mean that there are 173 Titan vehicles which are usable or available for commercial purposes?

Mr. FLORA. No, sir. Included in that count, of course——

Mr. BATEMAN. I suspected it could not be that easy.

Mr. FLORA. Included is the whole Titan I and II program which is the Titan program, starting in 1955. The Titan I's were essentially destroyed after they came out of the silos, and were not used for any expendable activity.

The Titan II's in question are just coming out of the silos. So included in the count are some already destroyed and a few coming out of the Titan II silos.

Mr. **Bateman**. Here again I risk using inappropriate terminology, but what would be the quantity of available, already-produced Titans which have not become technologically obsolete.

Mr. **Flora**. All the Titans that we are building, sir, are designated by the Air Force for their activity. Our commercial venture is starting fresh in 1983 building four new ones.

Mr. **Bateman**. We are not talking about an existing inventory available to the commercial market.

Mr. **Flora**. That is correct.

Mr. **Bateman**. Do you have any feel yet for how many vehicles you would expect to produce, say, in the first 3 years of commercial activity?

Mr. **Flora**. As I mentioned earlier, our goal is four a year, so in the first three, our goal would be to produce and launch 12, starting in 1983 with the launches starting in 1986.

Mr. **Bateman**. Mr. Chairman, I suspect were I able to read further, I would have more questions. But I will suspend for now and perhaps be able to come back.

Mr. **Volkmer**. Thank you. The gentleman from California, Mr. Mineta?

Mr. **Mineta**. I would be more than pleased to yield part of my time to my colleague from Florida.

Mr. **Nelson**. I wanted to ask Mr. Flora how many Titans there are, and through what period of time is the Air Force committed to.

Mr. **Flora**. In this context, the Air Force has built their inventory of all the Titan 34d's with the latest cancellation of 15 and 16. I think it is a matter of public record that they will then have 12 of those 34d's left for their use that are designated for launches in Florida through 1985 and beyond that at Vandenberg.

Mr. **Nelson**. So they have the capability with Titan through——

Mr. **Flora**. In Florida, sir, through 1985.

Mr. **Nelson**. And Vandenberg?

Mr. **Flora**. Beyond that.

Mr. **Nelson**. For how long?

Mr. **Flora**. I don't think it would be appropriate for me to comment in this forum. But it is beyond 1985.

Mr. **Nelson**. Do you have an opinion with regard to this interagency group, that if we go the commercial expendable route, what agency of Government ought to head up this effort?

Mr. **Flora**. No. As I said, earlier, we have been working with some people in State, because of the tariff activity and the ITAR transferring of data to Intelsat and so on.

Certainly, we have had no problems there. We have talked to some people in Commerce.

In summary, we don't have a position that we would recommend one or someone over the others today.

Mr. **Nelson**. Thank you.

Thank you.

The gentleman from California?

Mr. **Mineta**. Mr. Flora—your position is what?

Mr. **Flora**. I am currently the program manager or director of the commercial Titan program for Mr. Teets, who is our vice president.

So I am responsible for our activities in getting this program off the ground for Martin Marietta.

Mr. **Mineta**. And the cancellation of 15 and 16, what impact does that have as far as the commercialization is concerned?

Mr. **Flora**. What happened with the cancellation of 15 and 16 is the Air Force continued to produce additional hardware in kit form, additional upper stages, that they had planned to build, and they have decided to modify two other vehicles to replace the cancellation.

So in summary, the build activity goes on such that as we start into our Titan commercial production, we will pick up those people that will be coming off the Titan program.

It had minimal impact because of those reasons.

Mr. **Mineta**. What was the per vehicle cost on 15 or 16?

Mr. **Flora**. I don't have those figures, sir.

Mr. **Mineta**. And would you have any idea what the buyout costs would be, based on the cancellation of vehicle 15 and 16?

Mr. **Flora**. I really do not know how those negotiations will come out. But it is very complicated because in that buyout are some modifications and turning some of that inventory into spares and also modification of hardware for other boosters.

So it is not a single number. I certainly don't know the number. It is very complicated right now. Those discussions are just starting with the Air Force.

Mr. **Mineta**. You had indicated that the ELV is complementary and not competitive with the space shuttle. Your testimony also seems to suggest a sharing of the space launch pie. I am wondering if you could comment or expand on that?

Mr. **Flora**. As I said earlier, we believe that the market for commercial satellites that is out there in 1986-87-88 indicates there is room for an expendable vehicle to coexist with shuttle. So for that market pie we propose we would fly those satellites similar to the way they fly in shuttle to low Earth orbit and allow them an alternative, or they can mix and match their own satellites like Intelsat we feel will do, for example.

Mr. **Mineta**. That is based on four orbiters?

Mr. **Flora**. Yes.

Mr. **Mineta**. And a fifth—just again to sort of go back over this—what happens if a fifth orbiter comes on?

Mr. **Flora**. If a fifth orbiter comes on, obviously one has to look at the year it comes on, the capabilities of that orbiter and what the reason for the orbiter is, and what other programs will be on it besides commercial satellites.

Having solved all those things, if the fifth orbiter takes away enough satellites, then we will not be in the market. We are taking that risk, if you will, that in 1986 and 1987 there is a market there, and we are willing to step up to that.

Mr. **Mineta**. You are actively pursuing marketing of Titan?

Mr. **Flora**. Yes.

Mr. **Mineta**. And, of course, you are familiar with the Farnborough Air Show, and the one that takes place this year in Paris?

Mr. **Flora**. Yes.

Mr. **Mineta**. Did you exhibit Titan at Farnborough last year?

Mr. **Flora**. Not to my knowledge of it, certainly not commercial Titan.

Mr. **Mineta**. Did Martin Marietta have any plans to display Titan at Farnborough?

Mr. **Flora**. Next year, sir?

Mr. **Mineta**. This last year?

Mr. **Flora**. Not to my knowledge.

Mr. **Mineta**. What about next year? Do you plan to maybe do that then?

Mr. **Flora**. It would seem appropriate. But I know of no plans at this point to display there.

Mr. **Mineta**. Are you going to be displaying at the Paris Air Show?

Mr. **Flora**. We will be in Paris with brochures and with contacts, yes, so we will be active in Paris.

Mr. **Mineta**. Were you planning to take a Titan over there to display it?

Mr. **Flora**. At one time, we had some thoughts along that line, but we have decided to feature our TOS, which is our next adventure into space. That is the transfer orbital stage. We plan to display that and tie that in with how we can fly it on the shuttle or the 34D.

Mr. **Mineta**. To go back to the previous question, I asked about the subtle or direct pressures from NASA about your not exhibiting a Titan at the air show, are you familiar with anything of that nature?

Mr. **Flora**. Not to my direct knowledge. We are trying to develop our strategy for Paris, and the strategy we have right now is that we will use brochures and posters and those kinds of activities.

Mr. **Mineta**. But there is nothing as exciting as the real thing.

Mr. **Flora**. It would be very hard for me to get a real Titan over there, sir.

Mr. **Nelson**. Would the gentleman yield?

Mr. **Mineta**. Be more than pleased.

Mr. **Nelson**. When did the Air Force cancel 15 and 16?

Mr. **Flora**. I don't know the specific date. But it has been within the last 30 to 45 days, with discussions starting as early as March.

Mr. **Nelson**. How much along in the production line are 15 and 16?

Mr. **Flora**. That is a very complicated question, because if you will, in the area of the launch vehicle booster core, we were just in details, had the materials bought.

In the case of the solids that support the core, we had one set of solids built, or just about built. They were just getting ready to start on those for 16.

In the case of the liquid rocket engines, they were finishing 15 and 16 liquid rocket engines within the next 12 months or so.

So it is complicated, where you are in the procurement cycle.

Mr. **Nelson**. For us laymen, you have a starting point with your planning and engineering and a finishing point when you set it on the pad ready for launch.

That is zero to 100 percent. Give me an estimate of where you are in the production line between zero and 100 percent on 15 and 16.

Mr. FLORA. Considering the total vehicle, I judge about 35; 30 to 35 percent.

Mr. NELSON. For both?

Mr. FLORA. Yes.

Mr. NELSON. And that would be a vehicle that would be commercialized, 15 and 16.

Mr. FLORA. No, sir. Our plans do not include the hardware for 15 and 16. Those are Air Force inventory that we understand they may use for spares or other activities.

Our plan is to start building four new ones in about 45 days, we hope.

Mr. MINETA. Mr. Chairman.

Mr. VOLKMER. One question.

Mr. MINETA. Let me ask this. What was the IOC for vehicle No. 15 and the IOC for vehicle 16?

Mr. FLORA. Let me say it was in the 1985 timeframe.

Mr. MINETA. All right.

Thank you.

Mr. VOLKMER. The Chair will now recognize Mr. Chandler.

Mr. CHANDLER. I have no questions, Mr. Chairman.

Mr. VOLKMER. Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman.

As you approach your commercialization program, looking, say, toward 1990, how many Titans do you figure you will sell?

Mr. FLORA. As I said earlier, our goal is four a year and we will reorder production every year based on our marketing ability in the 3 years hence.

Mr. WALKER. How many jobs does that make?

Mr. FLORA. We are estimating that at a rate of four a year there are 6,000 jobs, counting all our subcontracting activity.

Mr. WALKER. Have you done any estimates of how many jobs would also be involved in the launch of the vehicles, the estimate of the number of jobs that would accrue from the satellites you would put into orbit with these vehicles?

Have you done any macroimpact studies of job impact of the overall commercialization program involving the Titan?

Mr. FLORA. No, sir, we have not. That would assume that commercialization of Titan was going to create more satellites.

We have not made that assumption. So we have only worked the potential of our own hardware.

Mr. WALKER. In your opinion, what are the things that most stand in the way of commercialization at this point, not only of Titan, but of the space program as a whole?

Mr. FLORA. I don't know that I have a "tall pole." The tall pole is getting Government authorization. We are working very hard with DOD, now that the President's policy has been released, to get that authorization. So the tallest pole, I guess I would say, would be the authorization by DOD to use the facilities to do it.

Mr. WALKER. So far as you are concerned, the economic viability of commercialization is there. The thing which stands most in the way at the present time is Government?

Mr. **Flora**. Getting that authorization from the Air Force. But I believe that is being worked very hard right now. We are working with the Air Force right now on that.

Mr. **Walker**. But when you arrange the priorities, and when you make the decision about commercialization, the thing that you find that is most frustrating you are up against right now is Government?

Mr. **Flora**. No. I think you took my answer out of context. The most important thing right now is Government approval. We have probably three things that are very difficult.

First is, of course, Government authorization.

Second, is developing a team and the financial resources to be able to produce and bet that you will sell them.

And third, and just as important, is finding a user out there.

Mr. **Walker**. You are the people that have to make those kind of decisions. What is the greatest frustration standing in the way of commercialization at the present time?

Mr. **Flora**. Winning the Intelsat VI bid.

Mr. **Walker**. All right.

If I understand your statement correctly, generally you are saying that less government is probably the best government in terms of the future of commercialization of space, is that a fair characterization?

Mr. **Flora**. As a generalization, yes, in terms of regulations and involvement.

Mr. **Walker**. Let me ask about a couple of areas where we might be able to be of help.

Would it be useful for the National Space Act to be amended to make it one of NASA's goals to help promote commercialization of space?

Mr. **Flora**. I cannot believe that would do anything but help, yes, it would help.

Mr. **Walker**. And if there were other opportunities to do similar kinds of things, do you think that Government laws—where we end up trying to push them toward more commercialization—would be a help rather than a hindrance?

Mr. **Flora**. If the Government laws don't put impediments or roadblocks or additional regulatory routes, yes, with that caveat.

Mr. **Walker**. What I am talking about is just making certain that one of the roles of Government is not to be an impediment, but to rather be a facilitator of commercialization.

That would have some merit.

Mr. **Flora**. Yes. That would help.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Volkmer**. The Chair will now recognize Mr. Lowrey.

Mr. **Lowrey**. No questions, at this time.

Mr. **Volkmer**. I do have a few questions.

In the statement of Mr. Teets', he addressed Mr. Akaka's legislation with some recommendations to issues that the Act omits. Assuming those recommendations directing DOD and NASA to allow private sector use of Government launch facilities, encouraging DOD and NASA to allow use of Government designs, and adequate assurances on testing rockets before they are permitted to be launched—assuming it was in there, would you then support that legislation?

Mr. **Flora**. Yes; I think we would support that as a strong signal again of the Government's intent to support——

Mr. **Volkmer**. You see no impediment in that legislation as far as you are concerned?

Mr. **Flora**. That is correct.

Mr. **Volkmer**. And at the present time, isn't it true that the fact that this is a first time for the Government, on NASA and DOD to be starting to turn over assets, or lease assets to the private industry, that it is going to take a little time to work out details, is that recognizable?

Mr. **Flora**. Yes. We understand that there will be negotiations and details to be worked out. The strong signal from the Government, though, does help us with the viability of our proposals.

Mr. **Volkmer**. You see nothing in the Congress right now that would make you hestiate as far as commercialization.

Mr. **Flora**. No, we are ready to press on, sir.

Mr. **Volkmer**. All right.

Anyone else have any further questions?

Mr. **Bateman**. Mr. Chairman, I have one further question that follows up on your inquiry concerning Mr. Akaka's bill.

As I read the written statement, it indicates at one juncture that your Legal Department really does not perceive the need for any legislation, and then in the next paragraph, it seems to suggest that the legislation that has been introduced would be improved if it addressed several subject matters.

It there a paradox there?

Mr. **Flora**. Perhaps a paradox of the author. What we are saying is we don't see the need for legislation to let us press on with our activity with the Air Force now that the President has made his policy statement.

However, we were asked to comment directly on the bill and we did that.

Mr. **Bateman**. Well, there is also a reference to there being no need for any further Government investment to commercialize Titan, but what is needed is that no institutional barriers preclude our implementation.

Have any such barriers been removed now by virtue of the President's statement, or are there other remaining barriers that need to be addressed?

Mr. **Flora**. To my knowledge, today, the President's policy is a real step forward. I know of no barrier where we are reluctant to continue the activity.

Mr. **Bateman**. Thank you.

Mr. **Volkmer**. One quick last one. I know you stated in your statement that you will work with anyone in the Government on commercialization. Recently the working group designated temporarily—until we get a permanent thing—the State Department to be the focal point as far as commercialization is concerned.

I won't ask you whether you agree with the choice being the State Department or not. I will ask you whether or not you have disagreement with, say, the Department of Commerce or the FAA being a focal point?

Mr. **Flora**. No; I think we can work with any of those agencies in working through our problem. As I said earlier, the interim decision of State was acceptable to us because we have worked with them on issues of commercialization.

Mr. **Volkmer**. I know everyone will have to work with the State Department as long as we have international implications.

I thank you very much, Mr. Flora, for being here. You have been very helpful.

[Mr. Flora's answer to a written question follows:]

Question. Do you anticipate the purchase or lease of any government facilities and, if so, on what should the government base its selling price or lease fee?

Answer. Martin Marietta Aerospace has proposed principally the lease of the government's Titan facilities and equipment as part of our commercial Titan endeavor. The basis for remuneration to the government for these transactions is the subject of continuing negotiations with the USAF, and is not yet clearly resolved. One thing is clear however: Defense Acquisition Regulations are specific on determination of lease fees and we have applied those guidelines in the negotiations we are conducting with the Air Force concerning the use of government facilities. Excess materials (hardware and, especially, propellants) we would expect to purchase; we have proposed determining their value to our program as the basis for purchase price, and are presently determining that value. As a final step in our negotiations, we propose to show a balance of the fees and prices determined as described above against the value to the U.S. Government of a successful commercial Titan program, thereby minimizing actual costs to our program of acquiring the necessary facilities, equipment and materials.

Mr. **Volkmer**. At this time we will ask Dr. Klaus Heiss, former president, the Space Transportation Co., Inc., and Mr. Allan McArtor, President and Chief Operating officer, FEDEX Space Transportation Co.

Your statements will be made a part of the record in total. You may review your statement in total or if you wish you may summarize.

STATEMENTS OF DR. KLAUS HEISS, FORMER PRESIDENT, THE SPACE TRANSPORTATION CO., INC.; AND ALLAN McARTOR, PRESIDENT AND CHIEF OPERATING OFFICER

Dr. **Heiss**. Thank you very much for the opportunity to present my views on the question of commercial space transportation issues and opportunities. First I would like to inform the committee about a most positive and very significant development. With me is Allan McArtor, vice president of Federal Express and now chief executive of FEDEX Space Transportation. Most recently Federal Express and SpaceTran have entered into an agreement in which the commercial activities are turned over to FEDEX, a subsidiary of Federal Express.

Mr. McArtor will address any specific issues concerning the commercialization of Titans. I believe that the entry of Federal Express significantly strengthens the commercialization of the Titan program. My own involvement in this and related questions dates back to the late 1960s and early 1970's.

In the late 1960's and early 1970's I directed the economic studies that led to among others the consideration of the space shuttle that in early 1972 was decided on and then built.

In the midseventies I had the privilege of developing the framework of economic principles that were to underlie the space shuttle user charge policy for NASA. In February 1979 I founded the first

U.S. company whose sole objective it was to bring about the private organization and financing of space transportation systems, and since then I have been very active in market-based initiatives of both the space shuttle and U.S. expendable launch vehicles, the Titan launch vehicle system in particular.

The issues and opportunities in the commercialization of space transportation are several, among them, one, commercial opportunities of the space shuttle system such that the private sector, rather than taxpayers, ought to be asked for the funding of an additional space shuttle orbiter.

Second, should one create a Government monopoly in U.S. space transportation or should one follow a market oriented, competitive approach between any U.S. space launch systems willing to risk private funds in commercial enterprises.

Third, can and should ELV's compete with the space shuttle in world space transportation markets, and why.

And finally, what are economically efficient roles for commercial ELV's and the space shuttle system to fairly—and efficiently—compete in world markets in the 1980's and 1990's.

To explore these questions, I have prepared a rather comprehensive written statement, which I submit with your permission for the record.

[The prepared statement of Dr. Heiss follows:]

COMMERCIAL SPACE TRANSPORTATION:
OPPORTUNITIES AND ISSUES FOR U.S. LAUNCH SYSTEMS

TESTIMONY OF DR. KLAUS P. HEISS

THE SPACE TRANSPORTATION COMPANY INC.
(SPACETRAN)
PRINCETON, NEW JERSEY

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

MAY 18, 1983

Mr. Chairman:

Thank you very much for the opportunity to present my views on the question of commercial space transportation issues and opportunities. My own involvement in this and related questions dates back to the late 1960's and early 1970's.

In the late 1960's and early 1970's, I directed the economic studies that led to - among other considerations - the space shuttle decision of early 1972; in the mid-1970's, I had the privilege of developing the framework of economic principles that ought to underly the space shuttle user charge policy of NASA; in February of 1979, I formed the first United States company whose sole objective it was to bring about the private organization and financing of space transportation systems; and since then, I have been very active in market leased initiatives of both the space shuttle and U.S. expendable launch vehicles - the Titan launch vehicle system in particular.

The issues and opportunities in the commercialization of space transportation are several, among them:

(1) are commercial opportunities of the space shuttle system such that the private sector, rather than taxpayers, ought to be asked for the funding of an additional space shuttle orbiter;

(2) should one create a government monopoly in U.S. space transportation or should one follow a market oriented, competitive

approach between any U.S. space launch systems willing to risk private funds in commercial enterprises;

(3) can and should ELV's compete with the space shuttle in world space transportation markets, and why; and finally

(4) what are economically efficient roles for commercial ELV's and the space shuttle system to fairly - and efficiently - compete in world markets in the 1980's and 1990's.

To explore these questions, I have prepared a rather comprehensive written statement, which I submit with your permission for the record. The key findings in the prepared statement include:

(1) Estimated Demand for Non-U.S. Government Space Transportation

- The key space shuttle issue identified in 1971 was the need for a strong U.S. space science and applications program to make use of the space shuttle in the 1980's. Such a program - parallel to the shuttle development - was not created in the 1970's. As a result, we see today a substantial reduction in the government demand - and possibly commercial demand as well - for space transportation flights for the rest of this decade.

- A substantial commercial and world market exists for space transportation services, estimated by us at between $10 billion to $15 billion from 1983 to 1995. Without an economically efficient

U.S. space transportation system, this market will increasingly be serviced by foreign launch systems.

- An assessment of the potential commercial demand for space transportation is summarized in Figure 1.1-1 and Table 1.1-2 of the prepared statement: a total of 183 commercial payloads from 1985 to 1995 are projected. These projections assume competitive operations costs and user charges.

- A more uncertain and exciting part is the demand for shuttle unique capabilities by the commercial sector. The most immediate of these - material processing in space - may range from a low of 42 payloads up to 234 payloads through the end of the century.

(2) Commercial Orbiter Opportunity

- The funding of Orbiter V is a pivotal issue to the shuttle and space program. When the nation decided in 1972 to proceed with the development of a new Space Transportation System, a minimum of five and possibly as many as nine orbiters were considered necessary for the 1980's and 1990's.

- Given the relative lack of U.S. Government demand for space transportation in the 1980's, the U.S. Government need for additional orbiters in the 1980's is uncertain.

- Given the commercial and worldwide space transportation market, and with the establishment of a reliable, fully operational government fleet of four orbiters over the next few years, the private sector can afford to fund one or more orbiters in the 1980's and 1990's. If Orbiter V were funded by the private sector, the terms and conditions will have to be on an additive cost basis for orbiter vehicle costs and the cost per flight reimbursement to the (government) operator of the space shuttle fleet throughout the life of Orbiter V.

(3) Commercial ELV Initiatives

- In the near term, the commercialization of U.S. expendable launch vehicles (ELV's) - such as the Titans, Atlas Centaur, and Delta, among others - will allow the U.S. to capture a significantly larger share of the world space transportation market. At the same time, such commercialization will discourage and delay the full development of foreign competition.

- A "Mixed Fleet" (space shuttle and ELV's) will capture a substantially larger share of the world space transportation market than either a "shuttle only" or "commercial ELV only" approach.

- The space shuttle share in world markets may be substantially larger with commercial U.S. ELV's (Titans in particular) since this would allow commercial payload users to grow to larger spacecraft sizes - a launch capability wherein the United States today has a monopoly.

- No new government funding is required to bring about the commercialization of U.S. ELV's. Let the market determine which system finds what role in worldwide competition. However, government decisions are needed right now to give U.S. ELV's a chance to compete efficiently in world markets.

(4) Competitive Cost and Pricing Issues

Basic to the success of commercial U.S. space transportation ventures is a fair, efficient, equitable and "market oriented" government policy on user charges - costs and prices. Fundamental therein is the requirement to have the space shuttle compete efficiently in world markets.

Mr. Chairman and members of this Committee: You may rightly question whether all these "adjectives" and objectives can be met by any policy, however well intentioned. Nevertheless, a rather straightforward policy is suggested:

- The delay in Orbiter V procurement and the concurrent reduction of the demand for space transportation have made a four-orbiter fleet cost inefficient throughout the 1980's: a "freeze" of the shuttle fleet at four orbiters for the rest of this decade will make the shuttle fleet non-competitive through possibly 1995.

- The operations cost per flight of a four-orbiter fleet will be at least $120 million (1983 dollars) averaged over a 12-year period - and may be even higher. An increase of the shuttle user charge from $71 million (1986 to 1988) to $120 million (12-year average operations cost per flight) will leave most of the commercial space transportation market to foreign ELV's.

- An additive cost ("out-of-pocket," incremental, marginal cost) pricing policy will have to be applied throughout at least the 1980's if the United States is not to lose world space transportation markets to foreign competition. In the 1986 to 1988 period, even "out-of-pocket" costs for the space shuttle will have to be partly subsidized by the government to meet the projected $71 million user charge for space shuttle flights.

- The user community should be asked to make the same contribution - per payload carried - to the recovery of costs of government facilities and services whether carried on the space shuttle or commercial ELV's.

- As long as space shuttle commercial user charges do not make any contribution to government facilities and services above real (actual) "out-of-pocket" launch costs, commercial ELV's should have similar - i.e., no cost - access to such facilities.

- The "out-of-pocket" user charge policy for the space shuttle and for ELV use of government facilities and services may have to be continued as long as foreign ELV's are competing on that same basis (or less) in world markets.

The United States cannot afford any other policy without seriously endangering its market share in worldwide space transportation in the 1980's and 1990's - a $10+ billion market.

Beyond the question of commercial space transportation activities is an affirmation of government and industry cooperation to realize the full potential for U.S. space enterprise in the next two decades.

The retrenchment of the U.S. space program in the 1970's - leading to the questions and issues of today - needs to be reversed by a forward-looking government space program, including a new space goal, that will make use of the technical capabilities created by the expendable launch vehicle technology of the 1960's and by the space shuttle of the 1980's. For the United States to advance and capture its part in space enterprise in the 1990's, government initiatives and private sector initiatives have to go forward jointly. The private sector can make its contribution with full government cooperation and efficient rules for the transition to more expanded commercial, private sector initiatives - including space transportation.

The U.S. aerospace industry has been the most dynamic and innovative sector of U.S. industry in world markets and is the largest contributor to net trade (exports minus imports): for every $1 of sales, the aerospace industry makes a net trade contribution of more than 20c; and for every $1 of sales, aerospace spends 20¢ on research, development and testing (see the table in prepared statement).

The aerospace industry has been for some time an example of successful government and industry cooperation. Let us continue this example in space matters: the economic stakes for the United States are enormous. Too much time has already past.

The commercialization of space transportation - particularly of ELV's - is not a "zero sum" situation where whatever the commercial sector gains, the government necessarily loses. Rather, like most economic issues, space in particular is a "positive sum" opportunity: if pursued jointly and fully, the United States' share in world space markets of the 1990's will be large indeed. Without such new direction, we may well repeat the mistakes of the 1970's, while other nations will catch up and overtake where the United States has led for so long.

In the context of such a new, forward-looking space program - centered around a new civil space goal, and an active policy of encouraging commercial enterprise in space transportation and space applications - the need for additional orbiters - including Orbiter V - will become obvious, and the private sector is willing to do its share to bring such funding about.

Mr. Heiss. Allan McArtor has a prepared statement as well and with your permission he will read it.

Mr. Volkmer. You may proceed, Mr. McArtor.

Mr. McArtor. Thank you, Mr. Chairman.

I would like to say that it is indeed an honor and privilege and I welcome the opportunity on short notice to address this committee and represent Federal Express in its space initiatives.

At the risk of being redundant with Klaus I would like to reiterate that much activity has taken place concerning commercial space ventures and Federal Express involvement in particular. With your permission I would like to once again review the sequence of events.

As many in this room have been aware, Federal Express has been a minority equity partner in the Princeton-based company, the Space Transportation Co., Inc.

As of last week, Federal Express and the Princeton group reached final agreement such that Federal Express would acquire 100 percent of SpaceTran's commercial Titan program and will continue to pursue that program under the name FEDEX Spacetran.

We took this step in order to present Intelsat with the best possible proposal for launch services of Intelsat VI spacecraft. As you are aware, Intelsat VI will enter into launch services contracts in June or shortly after.

I hope this committee strongly supports such initiatives.

Initially and specifically, Fedex Space Transportation Co. will be a wholly owned subsidiary of Federal Express and will devote itself, as a service company, to the pursuit of commercial space initiatives. It is anticipated that I will assume the chief operating officer position of Fedex Spacetran and Fred Smith, the founder, chairman and chief executive officer of Federal Express, will be chairman of Fedex Spacetran.

I would like to assure this committee and the industry that our entry into the emerging commercial space arena is done with caution. This is not a philanthropic gesture on our part nor simply an adventure. We intend to identify the appropriate niche for commercial involvement and to profit from it.

We do not intend to replace Government nor to absolve Government of its responsibilities in space operations. However, space transportation and the attendant services surrounding space transportation can begin to involve the private sector now.

We feel it is particularly appropriate for Federal Express to not only be involved in commercial space operations but to assist the government and the industry in developing appropriate policies, procedures, and controls so that this new frontier can provide new opportunities to those bold enough and imaginative enough to pursue them.

Federal Express is very much involved in new technologies of all kinds including an ever increasing use of communications satellites. It was our interest in launching our own satellite systems which led us to enter this particular area.

We operate our aircraft fleet to standards of unparalleled reliability, and our determination to provide totally reliable and predictable services make it only fitting that these management philosophies be transferred to the disciplines required of space operations.

Fedex Spacetran is not, however, a traditional "aerospace" company and hence not burdened with a vested interest in a particular piece of space hardware. Rather, Fedex Spacetran is a service company—able to look at the user community objectively and to provide services that are totally responsive to their needs. The industry is being told that this capability is needed.

Long-range plans of Fedex Spacetran might include launch services and marketing services for shuttle and ELV's, development and marketing of upper stages, financial and insurance programs, payload logistics, and other related services.

Our current activities involve our commitment to commercialize the Titan launch vehicle and to position the Titan as the most reliable and flexible ELV to augment the U.S. space transportation system.

I want to once again say that Fedex Spacetran is not in the business of buying, selling, and launching Titan launch vehicles. We are in the business of delivering customer payloads to precise orbit at the precise attitudes they wish them to be. We chose the Titan to deliver this service to our customers. We chose the Titan because of its reliability, throw weight capability, its flexibility, and because of its availability.

How do we see the role of Government?

If we can assume—and I believe all of us here in this room can—that commercial space operations are certainly in the national good and are as strategic to our economy as energy exploration and other transportation infrastructures, then one, the Government should provide, maintain, and operate launch facilities and ranges just as it does with harbors, canals, bridges, airports, highways, and other transportation bases that allow the commercial operator to access this base under some appropriate but not burdensome user fee basis.

In this regard I endorse the concepts and comments of Mr. Reynolds in yesterday's hearing.

The Government should encourage private initiatives in space through tax incentives, loan programs, or even guarantees. Again parallel to other initiatives in this Nation.

Space development corporations similar in design to SBIC's or MESBIC's might be set up to not only encourage initiatives, but to provide necessary startup capital. This could involve a larger entity than the MESBIC's.

Four, an interagency group should be formed with the authority to develop appropriate oversight controls and to implement the government's commercial space program. Currently, no single agency has all the necessary skills to become the lead agency at this time—and it would take too long to educate any given one without delaying the commercial initiatives now underway. Plus, a special commission could operate on a new and streamlined basis.

As an example, NASA has all the space expertise, but the FAA has experience in licensing and administering controls, et cetera.

I would suggest each commercial space launch services company should apply for a license, and we are familiar with the air carrier application process, that includes a demonstration of technical competency and that pertains to a particular class of launch vehicle using specific fuels. These certificates would parallel the authorities granted air carriers today. This license would permit it to operate certain vehicles with certain fuels. If it wished to engage in some other launch vehicle it would have to get that added to its certificate of operation.

As a couple of side comments that I have taken in observation of other testimony, I would like to say that to those that do not take Ariane seriously and figure the United States has a lock on space technology, such similar thoughts were observed in the United States when the—Air Bus—first proposed a jumbo jet.

I think we learned a lesson from that.

I would also suggest—and I won't ask for it to be in the record—but a very good article was written in the magazine High Technology called Rocket Wars, that pinpoints the conflict or potential conflict between Ariane and U.S. launch vehicles.

Again the economic benefits of a commercial ELV—and in particular a commercial Titan—would be the reduction or elimination of any closeout costs for such a program, preservation of jobs both in production and launch services, balance of payments and trade, and the corporate memory and production infrastructure that goes into the Titan production line.

Certain operational benefits are those payloads perhaps even hazardous ones that would not be appropriate for transportation on shuttle, or—as some have observed—payloads that do not require the specialty and perhaps might wear out if you will, a shuttle by taking them into orbit.

It certainly encourages shuttle optimized payloads and by that I mean that the Titan—as Mr. Flora pointed out—will be designed with a 14-foot payload faring and certain interface connections such that a payload manufacturer could design the diameter and weights of a shuttle optimized system knowing that his backup or dual compatible system was a U.S. ELV.

The preservation of the Titan as a commercial program has far reaching national security implications.

One final observation, I would say that space capacity is a self-fulfilled prophesy. If there is the capacity in the United States to launch 20 payloads per year, we will have 20 payloads per year. There will not be major satellite programs waiting in the wings to go on a space transportation system that does not have the capacity to deliver it.

If we have the capacity for 30 there will be 30. If we can shoot 40 there will be 40. Somewhere along the line if you have a capacity of 50 there may only be 46, but we will not reach that for some time.

So to those that would suggest that we have only four Orbiters instead of five or the ELV should or should not come along, I would say the transportation infrastructure has to be put in place and the business will follow it.

Nobody will invest substantial money in a sophisticated satellite system without being assured that they have the ability to launch it into orbit.

In closing, I would simply like to reiterate that in order for the United States to retain its supremacy in space operations and exploration, it must provide totally responsive services to meet the needs of the space user community. This industry that will approximate $10 billion and in some cases $20 billion in only a decade has already expressed the necessity for a viable space shuttle program plus a reliable ELV, a broader based finance and insurance pool, and a streamlined process for assessing the space transportation network.

Federal Express Corp., through its subsidiary FEDEX SpaceTran, looks forward to making a positive contribution to the solution of these commercial space problems and to enhance this nation's space transportation system.

Mr. VOLKMER. Thank you very much, Mr. McArtor.

We will proceed under the 5-minute rule.

Mr. Nelson, please.

Mr. NELSON. Thank you, Mr. Chairman.

Dr. Heiss, what happened to SpaceTran's attempt to acquire a fifth Orbiter?

Dr. HEISS. I am glad you asked the question. In turning over the Titan-related commercialization business the old SpaceTran fully intends and will carry forward—now disencumbered of the ELV aspect of space transportation—its initiative on funding of a Commercial Orbiter. We are totally dedicated to see that initiative through.

As you know we submitted a proposal to NASA in February 1982, we discussed it with NASA now for many months, and we resubmitted the principles on which that initiative should be based to NASA in April 1983. Once these principles are resolved this Nation can look forward to commercial funding of an orbiter.

Mr. NELSON. All right.

Dr. HEISS. We would continue that effort and we will lead it.

Mr. NELSON. Is there not an inherent competition within your own house here and how do you analyze that?

Dr. HEISS. Let me take some time on this question and how we ended up in choosing Titans as a backup to the commercial orbiter initiative. It is at the heart of these hearings today.

Once we decided on commercial funding of an Orbiter—one is talking about at least a $1 billion investment—the idea is to then market this orbiter to the worldwide commercial community much like commercial entities market the European space launcher system.

When talking to the users, paramount in the users' mind is that if I, a user, commit on the payload side half a billion dollars or $1 billion—like Intelsat has in Intelsat VI spacecraft what assurances do I, the commercial user, have that the investment will not stay on the ground but will be in orbit in 1986 or 1987.

One transportation option is the space shuttle system. The shuttle user charges are extremely competitive and the commercial users have been increasing for the past 5 or 6 years and will continue to do so. However, the difference between the shuttle user charge on one side, take Intelsat, $55 million, and the requirement by the user to have absolute certainty in 1986, and 1987 that the investment will be in orbit irrespective of what happens to the shuttle are in conflict: who is to tell us the shuttle will achieve its accomplishments in 1986? We all hope so but adverse things can happen.

So commercial users are adamant in requiring an expendable alternative to the reusable shuttle system, however good the shuttle is. Now what you observe in commercial markets today is that all commercial payloads, whoever finances them, are designed to be carried on expendable systems and the shuttle.

You will find Delta-class payloads designed to fly on Delta-class vehicles—domestic and worldwide—of that small class. You will find satellites capable to be launched on the Atlas Centaur, a slightly larger system than the Delta vehicle.

Yes, they also fly in the shuttle. But you do not find—other than Intelsat VI—any commercial investment that size which does not have an expendable backup.

Now, if you look at Intelsat VI, Intelsat decided to proceed with that size spacecraft only after being promised an expendable backup by Aviane IV. That promise is receding in time as to technical capability and reliability—but Aviane IV will be there sometime in the future. It is very important for this committee to understand that just having the shuttle, the shuttle will not be the backup to the shuttle as far as the commercial users are concerned. So they will book even at twice the price a reliable expendable system and combine that with the shuttle.

The only question before this committee then is whether that expendable backup capable to go into the 1990's will be a U.S. vehicle, or family of vehicles, or whether it will be European. Let me also state that without commercialization of the Titan system in the United States, you are looking forward to a Japanese capability of this type in the 1990's.

Those are the issues before this committee. It is not a zero sum game with the shuttle: What payloads expendables launch are not necessarily taken away from what the shuttle launches. You will have to look at space transportation in a worldwide perspective. In that context we have thought very carefully about competition, particularly proposing a commercial shuttle orbiter initiative. We firmly believe that a commercial orbiter backed by an expendable backup, also commercial, has a fair chance—in fact will have a leading chance—to win the worldwide competition for space transportation.

Without such a backup this space shuttle—NASA—will become a marketing entity in the United States for foreign expendable backups. Commercial users will book on expendables abroad: commercial users will have to do so in order to justify to their boards and the investment community why to invest $1 billion in a commercial venture without a backup in case they don't have a backup to the shuttle.

Those are the issues.

Space transportation is not a zero sum game.

In the commercialization of ELV's the United States will look forward to capturing a very large share of a $10 billion-plus space transportation market worldwide, combined with another $10 billion in the spacecraft market and another $10 billion in the ground systems market. Without commercialization of ELV's I firmly believe that foreign ELV's will capture 40 to 60 percent of the competitive market, meaning the nonallocated—by government—demand in world markets.

So it is very important for this discussion here to get away from the zero sum thinking falacy.

Mr. **Nelson**. What percentage with American commercialized ELV's will foreign launchers have?

Dr. **Heiss**. It is my firm conviction that if commercialization is allowed to go forward not only will you see the Titans commercialized but Atlas Centaurs, probably Deltas will be continued on a commercial basis, maybe not. The more U.S. ELV's compete in world markets the less foreign competition.

Mr. **Nelson**. You gave us a percentage for no American commercial ELV. What is the percentage if we have them?

Dr. **Heiss**. With U.S. ELV's in the picture?

Mr. **Nelson**. That is correct.

Dr. **Heiss**. I don't want to forecast. It is always dangerous, particularly for economists, to do so. But I see serious problems for European launchers to advance to, say, the next generation of Ariane, even IV, certainly Ariane IV if you see commercialization of Titans in the country.

I think the Russian initiatives to offer commercial launch services to the Europeans as backup to Ariane will come to naught if they have not done so already.

And with an aggressive market oriented approach, with the assurance that these vehicles will be available to foreign users on a nondiscriminatory basis, a commercial basis, I think that Japanese efforts in space transportation will be substantially delayed in terms of deployment, not in terms of research.

They will do the research necessary to have the option in case they are denied at some future time access to this great American technology that we have not used to date for commercial services.

Mr. **Nelson**. If you can answer the question I would like for you to submit it for the record.

Dr. **Heiss**. Yes.

[The information follows:]

SHARE OF FOREIGN LAUNCHERS OF WORLD SPACE TRANSPORTATION MARKET, 1984–95

[With operations cost leased prices; in percent]

U.S. launch fleet options	U.S. share		Foreign share	
	U.S. market	Foreign market	U.S. market	Foreign market
Shuttle only:				
4 orbiters	50–70	10–20	50–30	90–80
5 orbiters	90	40–30	10	70–60
Shuttle and ELV's:				
With 4 orbiters	90	50	10	50
With 5 orbiters	100	65–75	0	35–25

Dr. **Heiss**. Again, I see a very small part for foreign ELVs, if all U.S. commercial capability is let loose.

Mr. **Nelson**. Mr. Chairman, my final question would be, can you meet with a Titan launcher the $55 million cost for launching in 1986?

Dr. **Heiss**. No, we never intended to. Titan has going for it reliability. There is no way that any expendable system can beat the present shuttle user charge policy.

It is a very well designed policy. It is my opinion——

Mr. **Nelson**. This is the policy through 1988?

Dr. **Heiss**. Yes, the way I understand it. It is changing between the lines, of course.

But I think the shuttle user change policy is a very well designed policy. It is my opinion that that policy should be kept in place well beyond 1988, particularly with a four-orbiter fleet.

If the fleet is enlarged to a larger size, say another two or three—or block buy in 1987 or beyond—then I think a more average cost oriented policy may be appropriate; but it is important for the current policy to be continued for 1986 to 1987.

Under that policy ELV's will not compete on a price basis with the shuttle. ELV's have going for them the certainty of launch. Titans today can contract for a date certain in April of 1986, and say that day that launch vehicle will be launched—come high or low water—as long as the commercial user is ready.

The commercial community does not have that with the shuttle system.

It is a system that is being broken in, where we learn how to operate it, whether we can operate 12 launches a year, 24 or whatever. These questions are going to have to be answered over the next 2 or 3 years as the shuttle becomes fully operational. Until that is achieved, commercial users will pay a premium for certainty of delivery.

Let me take an example.

When Federal Express started out with a thesis paper 10 years ago, if somebody had come to any investment banker and said:

> Look, I have this great idea instead of delivery with the postal service for 20 cents a letter, you should pay $10 a letter but I will make sure it is delivered next day at 10 o'clock.

I think most would have said, "Well, that is great, now when can we talk to you again on something else."

But the point is made, the value of certainty of delivery is critical. This is at the heart of commercializing ELV's. ELV's from the United States can give launch certainty as a backup to the shuttle where the payloads are compatible with the shuttle. The shuttle is priced cheaper, hence the users want to fly shuttle if they gain confidence. In the meantime they have an option to fly with certainty; that mixed strategy—certainly with ELV's and lowprice with shuttle—is at the heart of commercial success of U.S. space transportation in the 1990's.

Hence, ELV's do not have to be price competitive—on basis of price only—because they will beat the competition on reliability and flexiblity. One can wait around 30 days on the pad for the user with Titans. No other system can do so.

And launch assurance: Ariane is not here. Ariane does not exist with regard to Ariane IV. So this is the market gap entered by any and all U.S. ELV systems if they are allowed to proceed and be commercialized.

Mr. **Nelson**. Thank you, Mr. Chairman.

Mr. **Volkmer**. The Chair now recognizes the gentleman from California, Mr. Mineta.

Mr. **Mineta**. Thank you, Mr. Chairman.

Let me just ask one question. I chair the aviation subcommittee as you know, Mr. McArtor, and have had the privilege of being down there to see the operation at least of the parent company. So I know you will not be putting packages to deliver them by 10 o'clock the next morning in your operation.

But in terms of the Titan launch vehicle being commercialized, what do you envision in terms of the schedule or how would you like to see the transfer of inventory, tooling, drawings of the Titan vehicle?

Mr. **McArtor**. Those issues are being negotiated with the Air Force now, Mr. Congressman. Martin Marietta, as the lead technical partner in the commercial Titan venture, they are responsible for resolving those. I believe there are appropriate arrangements being negotiated for tooling, and use of facilities that were Air Force owned or Air Force facilities that will transition to the commercial sector.

Mr. **Mineta**. Do you anticipate site leasing or access problems?

Mr. **McArtor**. No, I don't think so. Obviously the launch site, the eastern test range is a sensitive area with high security and certain appropriate security measures will be required of any commercial activity there just as they are now.

As you well know, commercial contractors are entrusted with a great deal of the Nation's security anyway, once they are approved to do so. So I don't see any unmanageable problems in that area at all.

Mr. **Mineta**. Would you envision launch licenses to be issued for each private launch or should a license cover a particular period or specific class of launch vehicle?

Mr. **McArtor**. I think the class of launch vehicle and the operator should hold the license that is renewable annually. Notifications of launches that fall within their license would be provided to whatever oversight Government agency. Certainly I think that some oversight of payloads such that national security would have a preview, if you will, of anything going up that it would meet national security requirements would be in order.

Mr. **Mineta**. Now that last piece would be to do what? Make sure that—oh, I don't know, that a nuclear-powered something isn't shot off?

Mr. **McArtor**. Possibly nuclear powered, yes. I think our national security interests are curious about certain foreign payloads that might go up and I believe the ability to insure that anything that is launched commercial poses no security threat to the United States would be appropriate.

Mr. **Mineta**. And if your company is successful in taking over the Titan are you seeking any guarantees from the Government in regard to shuttle pricing and facility use?

Mr. **McArtor**. Well, we will endorse the President's recently stated policy on shuttle pricing as it relates to the time periods indicated.

We would certainly look for a guarantee of facility use. We would be ill-advised to enter into a major commercial venture without that assurance.

Mr. MINETA. I would be pleased to yield to my colleague from the State of Nelson.

Mr. NELSON. Thank you. From Cape Nelson?

Mr. MINETA. Cape Nelson, yes.

Mr. NELSON. I would just postulate this question to my distinguished colleague from California. I think these witnesses have all—including the gentleman from Martin Marietta—made an extremely strong case. I think the essential question that bothers me is whether commercialization of ELV's would diminish America's commitment toward the shuttle transportation system. And I can see that in some quarters of the Government they may be wringing their hands with glee that this is an opportunity for them to get off the hook of going ahead and commiting to a fleet of orbiters, including a fifth, sixth, or whatever, to service the space station and so forth.

I think that is my essential concern with this.

Mr. MINETA. Well, that is a fair observation. I know that also from another perspective as a member of the Intelligence Committee I want to be sure we are not caught shorthanded, that we have the backup capability, and so I think your point is well taken but I think there is also this other thing we have to keep our eye on.

So, I appreciate Mr. McArtor and Dr. Heiss being here to help us expand our own horizons.

Thank you.

Mr. VOLKMER. The Chair would also like to announce by the way that we have Congressman Akaka from Hawaii joining us, who introduced the legislation that precipitated much of this discussion.

At this time I recognize Mr. Bateman from Virginia.

Mr. BATEMAN. Thank you, Mr. Chairman.

Thus far we have heard almost exclusively references to the Titan as an expendable launch vehicle. Is that because it is perceived by those who are interested in commercial applications as being the highest state of the art or are there other expendable launch vehicles that may be as good or functional for specific missions or programs?

Mr. MCARTOR. Sir, if I could address that very briefly. I think each expendable launch system has its own character and has its own place in the commercial sector. Just as we operate DC-10's, 727's and Falcons, each one doing a particular job better than the other. I don't think you can say there is one sole surviving ELV in the United States that ought to be operational and the others not.

The Titan is particularly fascinating to us because of its throwweight capability. It certainly has more muscle than other ELV's in the United States. It has fine onpad flexibility time which is a heritage out of its silo days when it could be stored for long periods of time. It was extremely reliable and built so by the Air Force.

So taking all those into consideration, we found that the technical team of Martin Marietta & Chemical Systems and Aero-jet Delco, all made it very advantageous to us and served our purposes again to provide total reliable services to the most ubiquitous market we could find by using the Titan. That is not to say it should exclude any other ELV.

Mr. BATEMAN. One other aspect of what we are discussing today intrigues me, perhaps because of serving on the Committee on Merchant Marine and Fisheries. Do we foresee that we will produce some of these that will fly under foreign registry like the Liberians and Panamanians, or are we commercializing this in the sense of American registry?

Mr. MCARTOR. In anticipation of generous tax incentives by the United States, I think we could stay with the U.S.-flag registry.

Dr. HEISS. By the way, if I may follow up, any of the commercialization efforts that I know of in the U.S. expendable ELV's only propose to use U.S. launch sites and that is the context within which these efforts go forward.

Mr. BATEMAN. With reference again to the Titan, is it perhaps any way fair to say that in some instances it may give a user more boost for a buck than the user needs? Is that why there is room for the other expendable launch vehicles?

Mr. MCARTOR. Certainly there will be payloads that Titan would be overkill for. The Titan has the capability and has demonstrated multiple payload launches.

Yes, there are Delta-class payloads, Atlas payloads and Titan-class payloads.

Mr. BATEMAN. That is all I have. Thank you, Mr. Chairman.

Mr. VOLKMER. The Chair recognizes Mr. Chandler.

Mr. CHANDLER. I have no questions, Mr. Chairman.

Mr. VOLKMER. The gentleman from Pennsylvania, Mr. Walker.

Mr. WALKER. Thank you, Mr. Chairman.

I would be interested in the figure that you provided in your testimony with regard to the potential for a $10 billion industry, and you added then perhaps $20 billion industry, Mr. McArtor, by the end of the decade.

I would assume that is based on some study that you have done of the whole industry prior to making your decision to proceed as you have?

Mr. MCARTOR. Sir, we believe that the emergent space industry is in fact on the threshold of becoming very, very dynamic and as you know, we are not lacking courage in becoming involved in new thoughts and new concepts. Depending on how you look at the space industry, whether it is the launch industry itself or whether it is the satellite communication industry and the attendant ground communication industry that would support it, I would suggest that there is about a $10 billion launch services industry for the next decade combined then with the satellite communication industry itself ranging on up to $20 billion.

In being able to support such a growth potential, the United States has to establish and maintain its leadership in launch vehicles and in providing redundant systems within the United States.

Mr. WALKER. So yours is a fairly limited figure. When you go to $20 billion, you are talking about primarily communications and launch services in that $20 billion?

Mr. MCARTOR. Yes.

Mr. WALKER. Have you extrapolated at all how many jobs that might be by the end of the decade?

Mr. **McArtor**. No, sir. I have a lot of material on that, but obviously it is substantial.

Mr. **Walker**. I would appreciate if we could have that material provided for the record.

[The information follows:]

FEDEX
SPACETRAN

FEDEX SPACE TRANSPORTATION COMPANY, INC.
889 Ridgelake Blvd.
Memphis, Tennessee 38119

Telephone: (901) 766-7700
TWX: (810) 591-1771

June 20, 1983

The Honorable Harold L. Volkmer
U.S. House of Representatives
Subcommittee on Space Science and Applications
Suite 2321, Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Volkmer:

Again, thank you for the opportunity to testify before your subcommittee on May 18, 1983, and to share with you some of our thoughts on space commercialization.

The "commercialization of space" is perhaps too broad a classification. Several sub-classifications are timely topics, i.e. commercialization of launch services, commercialization of space applications in low earth orbit, continual commercialization of telecommunication satellites, and other "commercial" initiatives that seek to provide private sector resources and management in heretofore government provided space services.

The commercialization of any previously government sponsored program is historically and inherently risky as an emergent business opportunity. Yet, in most cases, the involvement of private enterprise has been able to streamline and to make more efficient these goods and services. It is vitally important for the private sector to begin to provide leadership to those appropriate space programs that now serve the public.

My thoughts on government provided incentives are simply to expand the government's policies on similar industries of national importance that are extremely capital intensive and require unique expertise. Examples are oil exploration, energy research, and in-house research and development.

Space operations should likewise be afforded appropriate incentives in recognition of the high risks, the national good, the long-lead-times before profits, the research expenditures and other non-recurring costs, the maintenance of strategic production capabilities and launch services, and the contribution of such private sector programs to the space prominance of the United States.

History is full of such bold government programs to encourage private sector involvement in areas where the government has paved the way.

Specific incentives could only be discussed when individual applications of "commercial space" are known.

Secondly, the issue of "new jobs" as a result of the estimated $10 billion commercial launch services industry...

Here two extremely important distinctions must be made...preservation of existing jobs and new jobs. The commercialization of ELV's has its most dramatic jobs impact on preserving the production infrastructure and the launch services of existing Air Force or NASA launch vehicles. Naturally, some new job opportunities will emerge, but they will be highly dependent on launch rates and will be to a large extent program management, services, and marketing type positions.

The development of upper stages and new launch systems will, of course, produce a substantial number of new job opportunities.

It is not clear to me, however, how we can provide the vitally needed jobs of "skill transition" that will be required to adapt the current labor base to the skills of the future.

Of particular note, is the foregone conclusion that without the U.S. ELV's, a significant transfer of U.S. dollars and technology will go offshore to Ariane, Japan, etc.

The above thoughts constitute a very general reflection of our thoughts and expand on my previous Subcommittee testimony. As more detailed concepts are developed, I will look forward to working closely with the Subcommittee to promote and enhance the commercialization of space.

With kind regards, I remain

Sincerely,

T Allan McArtor

T. Allan McArtor
President
FEDEX SPACETRAN

TAM/jhm

Mr. **Walker**. I was doing quick figuring here based on national GNP, a $20 billion industry is 700,000 jobs that we are talking about that we would be having as new jobs by the end of the decade. That is substantially more than most of the programs we talk about around the Congress and it seems to me it is something we ought to be interested in.

In addition, if we talk about a narrow segment of the industry, that means we are talking about far more than 700,000, and at a time we are looking toward where new jobs will come from as smokestack industries are decreasing in size, it seems this committee is involved in where the jobs of the future lie.

Dr. Heiss, you wanted to comment?

Dr. **Heiss**. The $10 billion number, and the $30 billion that go with the $10 billion breakdown is $10 billion in transportation costs, $10 billion in spacecraft costs and—these are rough estimates—$10 billion in ground systems costs and probably the better the larger market if satellites become larger.

This is probably a low estimate: the volume could be as high as $50 billion. It is difficult to forecast. The Office of Technology Assessment of the Congress here has done its own projections which are substantially more positive to the year 2000.

The other references I would recommend are Battelle Memorial Institute and its projections, the American Institute of Aeronautics and Astronautics and its evaluations, the study we sponsored with Coopers and Lybrand broken down by payload class, and my testimony has some of that, information; the total jobs of the $30 billion—if that is correct. I would say about half is up for commercial competition—so you are talking about $15 billion, either here or abroad. The job estimates we came up with are more in the neighborhood of—200,000 high technology jobs in this country rather than elsewhere. Since aerospace engineers are to be paid higher than others, and not 700,000 jobs.

I think that is a good rough order of magnitude estimate of what is involved here.

Mr. **Walker**. Again, your figures are astounding and I think they are the kinds of things we need to begin to explain to the American public because if you are talking about $50 billion potential, that is——

Dr. **Heiss**. Total space market.

Mr. **Walker**. We are talking then within a decade of producing something on the order of 2 million new jobs in space and you are talking, also, then if you are correct that the $30 billion—dividing that in half—it could be as high as 600,000 jobs that we would give to other countries if we use present GNP figures and extrapolate to numbers of jobs.

I think that that says perhaps more vividly than anything else that we could do that, we need to move ahead aggressively to make certain that those jobs are not lost and to make certain that America benefits from where it has already established leadership throughout the period of our history that is what we have done, we have allowed that to produce new jobs.

Dr. **Heiss**. Let me suggest, Mr. Congressman, that we have a 60-year history in aerospace in the U.S. Government: first NACA up to 1958, predecessor of NASA formed in 1916, and model on how to do this and what the rules of NASA and the private sector should be.

I don't think it is good to have 747's built or run by the government. Since we followed the right approach in aeronautics—creating the largest, most competitive industry of the United States in world markets today, the largest contributor to the net balance of trade—we have to follow today the same policy, the same precedent and have the courage of the marketplace: then indeed the United States will capture the aerospace market in the 1990's.

If not, others will do the job for us.

Mr. **WALKER**. If I understand your testimony, what you are saying is by moving into ELV's, we will enhance not detract from commercial activities in space and therefore probably give ourselves the assurance that the shuttle will be more needed in the future, not less needed simply because it provides us with a climbing number of people who want to have launch services available to them.

Mr. **MCARTOR**. There is no question about that, sir.

Dr. **HEISS**. Let me take you back to the original shuttle decision in 1971. The space shuttle was compared to Titans at that time. The Congress was told in 1971 and 1972 that the space shuttle is not economic because of space transportation costs. On space transportation costs alone, the shuttle was a draw, maybe even a loser compared to expendables.

The economic reason for the space shuttle decision was payload effects. That is the type of payloads you could have, how you perform space missions, how you access satellites that may need more fuel to go to the right orbit, and so on. That was the justification for the space shuttle, the rationale.

Also included in payload effects was the ability to grow to larger masses, less complex payloads. Hence, with the Titan backup, in the transition period you will see the growth even of commercial payloads into this larger size. And then you will see only the United States being able to meet that market.

With commercial Titans and shuttles, we have a capability others do not have. Hence, with the Titan backup to the shuttle, we strongly believe the total market for the shuttle and Titans to be larger than without such a backup and with Atlas Centaur, for that matter, also.

Mr. **WALKER**. Thank you, Mr. Chairman.

Mr. **VOLKMER**. The Chair recognizes the gentleman from California.

Mr. **LOWERY**. Thank you, Mr. Chairman.

Dr. Heiss, you mentioned $30 billion, $10 billion in launch, $10 billion in satellites, and the final $10 billion was where?

Dr. **HEISS**. Ground systems, a rough order of magnitude.

Mr. **LOWERY**. Mr. McArtor, have you—I am sorry I missed some of the testimony. I had 40 students in from one of my local junior highs.

I took a survey just as an aside, to see what impact the aerospace industry had on them and of the 40, four of their parents worked for General Dynamics, one for Aerojet General. So that is 12½ percent of the work force out of this particular class connected with this issue.

Mr. McArtor, have you looked at pricing of the services you would offer?

Mr. **McArtor**. Yes.

Mr. **Lowery**. Would you share that with the committee?

Mr. **McArtor**. I would respectfully submit that our final determination of pricing of the Titan is not yet in focus.

Mr. **Lowery**. Do you have a range?

Mr. **McArtor**. I believe you would offer the Titan in the commercial marketplace between $70 to $75 million and probably $85 to $90 million depending on——

Mr. **Lowery**. Per launch?

Mr. **McArtor**. Yes, depending on the types of payloads and specialty costs that go along with it.

The argument for the Titan is not that it will be a cheaper way to go than shuttle under its current pricing policy. It comes, as we mentioned before, it comes with a great deal more value added than simply the pricing argument.

Mr. **Lowery**. Thank you very much.

Thank you, Mr. Chairman.

Mr. **Volkmer**. Now I recognize the gentleman from Hawaii, Mr. Akaka.

Mr. **Akaka**. Thank you very much, Mr. Chairman.

I thank you very much for giving me the opportunity to participate in this hearing.

I would like to ask Mr. McArtor a question about the testimony that was given today by Mr. Flora who posed the question whether existing legislation is adequate. So my question to you is do you agree with this? According to his testimony, he said, "A question is whether additional legislation is necessary. Our legal staff has found that existing legislation appears adequate."

So my question to you is, do you agree with this statement?

Mr. **McArtor**. Well, sir, I personally feel that it is academic as to whether existing legislation is adequate to do these things because we believe that it is certainly appropriate to have additional legislation and clarification from the Congress as to the oversight authority and the streamlining of accessing the space transportation network.

We endorse a Space Commerce Act, previously I testified that I would agree with your concepts of assembling expertise from a variety of agencies that together would make the nucleus of a streamlined and efficient group to determine the precise role of government. I would only question as to whether that should remain as an independent commission for some period of time, to then be absorbed in the appropriate agency, or whether it should grow within an agency such as the Department of Commerce from the beginning.

Mr. **Akaka**. I think you are familiar with my bill.

Mr. **McArtor**. Yes.

Mr. **Akaka**. I would like to designate the Department of Commerce as the lead agency. And also I would point out there may be a need for a group to oversee the transition of the bill into the Commerce Department for its implementation there. I think I sense from you that you see that there is a need for a transition to implement this idea.

Mr. McArtor. Yes, I would agree with that.

Mr. Akaka. I also note on your page 4 in your statement, and you state there that the government should encourage private initiatives in space through tax incentives and also loan programs or even guarantees.

What specific tax incentives need to be developed, do you think?

Mr. McArtor. I am not prepared to discuss the specifics as they might relate to space, sir, but my thoughts were that we firmly believe that the importance to the Nation as a whole for the national good, commercial space and commercial space development, are at least in parallel with energy exploration and other high value to society industries and that the government has taken the initiative and has provided certain incentives to encourage the private sector to expend capital in these other growth industries or vital industries and I would expect that government would feel the same toward space and commercial space activities.

Mr. Akaka. Are you suggesting that commercial space business receive preferential treatment in this?

Mr. McArtor. I would suggest that space industries receive appropriate treatment.

Mr. Akaka. Let me ask you about the loan programs and guarantees that you have referred to in your testimony.

Could you also be more specific about that?

Mr. McArtor. No, sir. I am not prepared to talk in specifics there.

Mr. Akaka. Let me then ask a question of Dr. Heiss.

In your statement on page 5, you point out that a four-orbiter fleet is cost-inefficient. How is that so and how did you arrive at that determination?

Dr. Heiss. The space shuttle needs a sufficient fleet size in order to be able to meet projected demand. I am firmly convinced that particularly with commercialization of ELV's, the demand for U.S. space transportation will indeed be there. With a four orbiter fleet and given the government priorities on access to space in them, the commercial users in our opinion will not have sufficient assurance and certainty that they will be launched on time when required by the commercial user.

For that reason back in 1978 and 1979 I took the initiative for private funding of an Orbiter V. If you go back to 1971 and 1972, very extensive studies showed that five to nine orbiters would be required for an efficient U.S. fleet. If you don't have sufficient fleet to meet the demand, then you are dividing roughly relatively large fixed costs of operations over a smaller and smaller pie.

If you require full cost recovery for a four-vehicle fleet the shuttle will stay and is uneconomic. That is why you need a fifth, sixth or seventh orbiter.

Mr. Akaka. Let me, Mr. Chairman, ask just one more question of Dr. Heiss and this has to do with your testimony on page 3, Dr. Heiss, dealing with commercial payloads.

I see differences in the estimated availability of the number of commercial payloads to the private sector. The Office of Technology Assessment estimates the number to be 245. According to your testimony, you state that a total of 183 commercial payloads from

1985 to 1995 are projected. Can you tell me how you arrived at your figure of 183?

Dr. HEISS. Let me first say that commercial people do differ about the market size so I wouldn't attribute particular importance to these numbers. In fact I would say the numbers are so remarkably close that I don't discern any difference.

Now, how we arrived at these numbers is by a look at the competition and then your own judgment. Our numbers presented here do exclude some of the items that were probably included in other projections but basically on page 11 of my prepared statement we have broken out Delta class and Titan class payloads, Atlas Centaur class, Titan 34-D and shuttle payloads, based on a very static scenario even with relatively conservative estimates not assuming any wide expansion of space activities.

You do look at a sizable market and there is general agreement as to the size on the down side, conservative side. I do consider these numbers to be conservative. On the up side, people do differ. OTA made a very, very optimistic projection which we don't share to that extent.

Mr. AKAKA. Thank you very much, Mr. Chairman.

Mr. VOLKMER. Thank you, Mr. Akaka.

I have a few questions.

In previous testimony, Mr. Flora pointed out that we have a memorandum of intent with Martin Marietta and United Technologies, Aerojet, Liquid Rocket Co. Is that correct, in the Titan commercialization?

Mr. MCARTOR. That is correct.

Mr. VOLKMER. You are basically working as a team, is that it?

Mr. MCARTOR. Yes, Fedex Spacetran will be the marketing entity and service company that is in partnership with the team of, led by Martin Marietta, to provide the Titan vehicle.

Mr. VOLKMER. The present negotiations are going on as far as the government properties, the tooling and so forth?

Mr. MCARTOR. That is correct.

Mr. VOLKMER. And with NASA and DOD as far as utilization of the launch sites.

Mr. MCARTOR. That is correct, sir.

Mr. VOLKMER. On the NASA properties, is that negotiation for—I will not ask for dollar figures, but someday I would like to see them because I think we have an oversight responsibility there—is that towards leasing or acquisition?

Mr. MCARTOR. If I may, sir, I would yield to Mr. Flora on that since those negotiations and discussions are led by Martin Marietta.

Mr. VOLKMER. I see. We will get it from Mr. Flora. We can do that in writing.

[The information follows:]

COMMERCIAL TITAN DISCUSSIONS WITH NASA REGARDING FACILITY USAGE

We, Martin Marietta, have had preliminary discussions with NASA for facility usage at the Kennedy Space Center. These discussions were for the intermittant usage of payload processing facilities that NASA currently operates. All discussions have been of the nature of a rental fee paid to NASA on a daily basis. No further discussion with NASA will take place until we have determined spacific payload processing needs prior to our launch activity.

Mr. **Volkmer**. Now, Mr. Flora also said they would probably have to review the idea of commercialization of the Titan based on let's say the Intelsat VI—if you do not get that—and also there was a decision made to go ahead by the Congress and this Government to go with a fifth orbiter. Do you agree that you have to review if those events would occur?

Mr. **McArtor**. Well, I would certainly agree that failing to have Intelsat VI select the Titan would certainly cause a reevaluation as to the market potential and viability of the Titan, and the time that it might take to put together a commercial Titan program, without an Intelsat VI selection.

With regard to the fifth orbiter, I don't see that as excluding a commercial Titan at all. As a matter of fact, we fully endorse the necessity for a fifth orbiter and believe that its requirement is not necessarily tied strictly to payload demand, but to run an efficient fleet, and to be able to take care of the extended onorbit missions and perhaps even leading into a space station—the fifth orbiter is required for other reasons, other than satellite market demand.

Mr. **Volkmer**. In other words, the fact that we go ahead with a fifth orbiter has no direct effect on your decisionmaking as to whether to go ahead with commercialization of Titan?

Mr. **McArtor**. Not as long as we are getting four launches a year.

Mr. **Volkmer**. Another question that I would like to ask is: Dr. Heiss, recently a published study by the National Academy of Public Administration on Space Commercialization suggested it is too early to commercialize the shuttle. You earlier said we should look to NACA and what we did in the airplane industry and do the same in space. That implies to me that we commercialize the shuttle.

Would you like to comment on that statement from the National Academy of Public Administration?

Dr. **Heiss**. I don't want to challenge such an illustrious panel, but I do want to say that we have to look back to the success stories in the space program in the United States. When the Comsat decision was made in 1962, the United States had not even launched a geosynchronous satellite yet. Some of the technology was even uncertain.

Yet, you know, the Nation then decided, after considerable debate, that for commercial ventures the commercial approach was the right one for the United States to lead. Indeed, after that we did lead and Intelsat is witness to probably the most outstanding success of international cooperation—led by the United States and by following a commercial approach.

I would submit that in space transportation, and particularly the space shuttle, one ought to incur similar risks. A commercial approach to the shuttle and commercialization—not just of the marketing but probably also of shuttle operations at some time—a more difficult issue—and beyond that probably a commercial operation of the transportation system—ought to be a stringent and exciting goal for NASA to look forward to.

So I do differ, I guess, with the NAPA conclusions. It is at the heart of the issues right here. We have to have a commercial market-oriented approach to make use of the space opportunities in the commercial world. We will not do so with essentially a Government-based approach.

Mr. VOLKMER. In other words, you are saying eventually we should commercialize?

Dr. HEISS. We should do it now. We should have done it back in 1973.

Mr. VOLKMER. The shuttle?

Dr. HEISS. Yes, absolutely.

The commercial aspect should have been part and parcel of the initial shuttle decision, certainly by 1979. In 1979 I was invited to Europe for views on how they should pursue their launch systems. I recommended a commercial approach. Now they are giving us a hard run for the money with fictitious vehicles while we have the shuttle.

Mr. VOLKMER. Would you say the first thing we should perhaps look at is the marketing, the payloads, and then the operations of it, and then——

Dr. HEISS. Much stronger, Mr. Chairman.

I think the private sector should fund the next orbiter, whenever a batch procurement of new orbiters is made. As you know, the private sector is the strongest component of the demand for the shuttle. The Government demand has sort of dissipated due to a lack of Government civil space policy in the 1970's. We do not have today the Government demand for the shuttle in the mid-1980's, because we don't have the payloads that obviously should be there to use the shuttle.

So the private sector non-Government demand for the shuttle is the strongest component today: It certainly fills up one shuttle — out of whatever shuttle fleet—if not much more, in the late 1980's. So why can not the private sector fund at least that vehicle that it makes use of? Why should the taxpayer fund it?

That is basically the issue, and it is an easy step that should be taken, but NASA finds it very difficult to sort of deal with a new source of funds that until now they had to come to you for funding.

It is a difficult step. I do not want to underestimate the issues involved. It should be done with due care, due consideration. But the time for commercializing the shuttle certainly is now, may have been already in 1979, 1980.

Mr. VOLKMER. But you are saying that we should only commercialize as far as the next shuttle or the next segment. We have two coming up. By December 1984 we will have all four of them. Should those be commercialized today?

Dr. HEISS. Well, one of them might be commercially funded out of the next batch, whether it is five or six, or another four—one of them should be funded privately. That doesn't mean whoever funded it runs off and uses it down in Brazil or sells it to the Russians. It is simply a funding mechanism. It is a very important issue. Private funding should be made available to simply find out and test: "is the shuttle economically viable now or does it really require government subsidization for a long time to come?"

It is a litmus test in my mind. I think private funding is feasible now. If it is not feasible, the shuttle has more problems than just technical ones. Then indeed the commercialization of ELV's may save the United States in the commercial market in the 1990's.

So that is basically the test on the feasibility of the commercial orbiter initiative.

Mr. Volkmer. Now, Dr. Heiss, how would a proposed fifth orbiter funded by the private sector be operated—by the private sector?

Dr. Heiss. Well, this is where we propose to NASA, after a year of discussions in April, a new set of principles which we hope to get agreement with NASA to proceed to a proposal that would implement whatever agreement could be reached or, if no agreement can be reached, fine, let's part ways.

But under that set of principles, the orbiter would be an integral part of the U.S. Government fleet, operated just as if it were government funded, by the same set of people, and maybe there are commercial entities sometime downstream involved in shuttle operations.

In the meantime, it is General Abramson and his very able leadership who would operate the privately funded shuttle as a totally integrated component of the present government fleet. Then if that principle can be agreed upon, the procurement itself would be done through NASA also. We are not proposing to change that.

And then comes the issue as to what are the marketing roles and rights are. Again those principles have to be agreed upon before continuing with another 4 years of effort that we already have put in. All of us have spent considerable effort to get these issues clarified to the present state.

Mr. Volkmer. Is the question of marketing and availability of payloads, guarantees, is that part of the problem?

Dr. Heiss. We are not asking in our proposed principles for any guarantees in the market. We do want to give the commercial users the commercial capacity, the priorities that I think the commercial users deserve if they funded an orbiter, that currently the Government or the Government fleet gives to Government users.

The priority of launch to commercial users to me is an integral part of making the shuttle a success. If you cannot offer commercial users the same close to absolute priority that Government payloads enjoy in the Government fleet, the shuttle will lag in international competitiveness.

We have asked for being allowed to give that priority to commercial users to the extent that the private sector has funded this capacity in the orbiter fleet.

Let me also come back to another question on Government guarantees and loans: commercial ELV's in my opinion do not require Government loans, they do not require Government guarantees, they do not require Government fiscal subsidization. What ELV's do require is, simply, the Government making it easy for the commercial sector to take over, for example, by not imposing a penalty tax "fees" on commercial ELV payload users, that the shuttle is not recovering from commercial users.

In other words, don't recover $5 million for range support and services and facilities for commercial users flown on expendable vehicles if the shuttle does not include such fees, nor recover out-of-pocket costs.

Mr. Volkmer. In other words, from its commercial payloads?

Dr. Heiss. That is right. From the same payload.

Mr. VOLKMER. My final question is: Dr. Heiss, would you comment on the degree that the Government should oversee the activities of private sector space venture?

Dr. HEISS. Some is required under international law. The United States entered into very important agreements in the 1960's with regard to the uses of outer space.

Next, the national security requirements of the United States require Government oversight.

Commercial ELV's do not require Government regulation.

Finally the last thing one needs is pricing regulation; the last thing one needs is Government guarantees to make it easier for commercial users, but oversight, definitely.

Mr. VOLKMER. Licensing?

Dr. HEISS. Licensing to the extent that that differs from current practices—probably. Let me also comment on the leadership that the State Department has taken in these issued on ELV's. The Department first raised, pursued and was rather imaginative in thinking on the issues involved in commercial ELV operations. That is not to say the State Department ought to be the regulatory agency, or better, the oversight agency, but I think the State Department deserves a lot of credit, that the commercial sector can pursue these opportunities today.

Mr. VOLKMER. I have no further questions.

Any other members have any additional questions?

I want to thank both of you very much for being here today; very informative, very helpful.

Mr. VOLKMER. The next witness we have is Mr. William F. Rector III, vice president and director of space programs, General Dynamics Convair Division.

Mr. Rector, your statement will be made a part of the record, included in full. You may wish to summarize or you can read the full statement, however you so desire.

STATEMENT OF WILLIAM F. RECTOR III, VICE PRESIDENT AND DIRECTOR OF SPACE PROGRAMS, GENERAL DYNAMICS CONVAIR DIVISION, ACCOMPANIED BY ROGER LYNCH, DIRECTOR, COMMERCIAL SPACE ACTIVITIES

Mr. RECTOR. Mr. Chairman, I would like to summarize my statement. I apologize in advance for my voice. I made a visit to Washington last week and, coinciding with that visit, I came down with a cold, and my colleagues tell me I have Potomac fever.

Mr. Chairman, it is a privilege to appear before this distinguished subcommittee on behalf of General Dynamics to participate in this series of hearings on commercial activities in space. With me today is Roger Lynch, who is the director of commercial space activities within my organization. My comments today will be focused on launch vehicle issues which have resulted from over 2 years of very serious assessment and analysis activities by our company, including numerous interactions with potential customers and responsible U.S. Government organizations. These hearings are very timely to us in light of the near-term nature of key milestones that we feel must be met before management and implementation responsibility of current U.S. Government space programs can be transferred to the private sector.

Events of this week have overtaken the statement that I had provided to this subcommittee, namely, the signing of the policy by the President of the United States on Monday covering the commercialization of expendable launch vehicles. If there are no objections by the subcommittee, I would like to submit that statement for the record and summarize some of the more significant issues therein. The timeliness of this new policy and subsequent negotiation of agreements have a major impact on our ability to transition our existing systems to the private sector in a cost-effective manner.

I am very proud to state that General Dynamics has been actively involved in the U.S. space program since its beginning, starting with the first flight of the Atlas rocket system in 1957. We have launched 471 Atlases for programs such as Mercury, Ranger, and Mariner, and are currently providing launch services for Tiros, NOAA, and NAVSTAR.

In the late 1950's, we began the development of the first cryogenic high-energy upper stage Centaur. This stage has been used 60 times in conjunction with the Atlas and 7 times with the Titan launch vehicle for such programs as Surveyor, Pioneer, Viking, and Voyager.

To date 69 commercial communication satellites have been launched by the United States, and one-third of these have been on Atlas/Centaur. Tonight I leave for Cape Canaveral where tomorrow evening we will be launching our 21st international communications satellite, Intelsat V, on Atlas/Centaur 61.

At General Dynamics we have continued to contribute to the U.S. space effort with our involvement in the space shuttle program. We designed and built the midfuselage for the Space Shuttle Orbiter and just delivered the fourth flight article, the Atlantis, 2 weeks ago. We are modifying the Centaur for use as an upper stage in the space shuttle, for the NASA planetary missions Galileo and International Solar Polar Mission. We will also be providing Shuttle/Centaurs to DOD for military missions requiring the high-energy performance capability of Centaur.

These comments on our background are germane to the discussion today and are intended to provide some insight into our belief that there is a need to continue using mature and proven launch vehicle systems that have performed so well for this country in the past. I would like to put the commercialization of expendable launch vehicles into a broader perspective; that is, the enhancement of the U.S. space program, national security, and economy.

In the early 1970's, a decision was made by the U.S. Government to phase down and eventually terminate the ELV's in the United States with the understanding that the space shuttle would provide all the launch services for the United States and other countries at a cost and schedule to satisfy all potential customers. As it turns out, the demand far exceeds these early predictions.

Numerous mission models have been created over the last 10 years projecting the launch vehicle requirements for the 1980's and 1990's. These models indicate a need for launch services for 245 commercial communications satellites in time period of 1986 to 1995.

These commercial communication launch service requirements present a classical supply deficiency which has always offered the private sector an incentive to participate.

As this subcommittee well knows, the European Ariane launch system has become a formidable competitor to the United States and is capturing much of this overflow due to aggressive marketing, creative financing, and so on. We believe the Ariane should not be allowed to take over the ELV business unchallenged. Since we were originally to be out of business in the early 1980's, I must sadly note that the next three Intelsat V communication satellites are scheduled to be launched by Ariane and two more in 1985.

There is another advantage in having commercial ELV's. You heard that earlier today. They could provide a backup capability to the space shuttle. Successful commercialization of the ELV's will create some offloading of the space shuttle manifest, which will provide the opportunity for using its unique properties—its size, the use of man, and its servicing and retrieving capabilities. We believe that coexistence of both the space shuttle and the U.S. ELV's will be beneficial in that both systems will operate more competitively and therefore more efficiently. We do not ask for nor wish to see any favored status of one system over another.

The space policy approved on Monday of this week is a step in the right direction. We are very pleased with this event, and believe it provides the basis to proceed. We look forward to an expedient action and implementation of the necessary agreements to allow the takeover of the tools, facilities, and equipment to manufacture, test, and launch the ELV's. It is needed to avoid the loss of an industrial base necessary for ELV's and to meet foreign competition.

The private sector could maintain, operate and preserve the U.S. national launch vehicle capability at no additional cost to the U.S. Government. We are proposing to reimburse the U.S. Government for added costs incurred in support of commercial operations from U.S. Government facilities. The eastern range is a good example of this, where the total operating cost would be reduced when the commercial flights are added to the U.S. Government flights.

The next major step now that we have a policy is to determine the range support and facility usage costs to be charged for commercial launches. We believe a simplified regulatory process is all that is necessary and do not feel that a new U.S. Government organization or structure is required.

We believe that there is an excellent opportunity to encourage the "privatization," a term that was coined by Ike Gillam of NASA, of the valuable natural resources that have been developed over these many years at a significant cost, and to preserve it for the long-term benefit, economy, and security of this great country.

We sincerely believe that the space shuttle and ELV's will comfortably live together and do so to the benefit of the Nation, each providing the service for which it is best equipped. Commercialization of ELV's will be an important step toward a broader base of industrial space-related activity.

Mr. Chairman, we solicit the support of the subcommittee toward these ends. I appreciate the opportunity to summarize our views.

I will be pleased to respond to your questions.

Thank you.

[The prepared statement of Mr. Rector follows:]

May 18, 1983

STATEMENT OF
WILLIAM F. RECTOR, III
VICE PRESIDENT, SPACE PROGRAMS
GENERAL DYNAMICS CONVAIR DIVISION
before the
SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

Mr. Chairman and Members of the Subcommittee:

Mr. Chairman, it is a privilege to appear before this distinguished Subcommittee on behalf of General Dynamics to participate in this series of hearings on commercial activities in space. My comments today will be focused on launch vehicle issues which have resulted from two years of very serious assessment and analysis activities by our company including numerous interactions with potential customers and responsible U.S. Government organizations. These hearings are very timely in light of the near term nature of key milestones and solutions that we feel must be met before management and implementation responsibility of current U.S. Government space programs can be transferred to the private sector.

We are awaiting the final signature of the President on the Space Policy covering Commercialization of Expendable Launch Vehicles that the Senior Interagency Group (SIG) - Space has been diligently preparing. As you will see, the timeliness of the release of this policy and subsequent negotiation of agreements has a major impact on our ability to transition our existing systems and their derivatives to the private sector in a cost effective manner.

Our company's involvement in space programs parallels the entire span of space activity over the past quarter century. The first flight of the Atlas rocket in 1957 occurred a few months before the Soviet Union successfully launched the first Sputnik. Our Atlas missions include such outstanding U.S. space programs as MERCURY, RANGER, MARINER, SCORE, OGO, TIROS, NOAA, NAVSTAR and others. More than 25 years later 471 Atlases have flown, 190 of them as space launch vehicles.

Shortly after the first Atlas flight, work began on this nation's, and the free world's, first cryogenic high energy upper stage-Centaur. In the more than 20 years since its first flight, Centaur has been the upper stage on 60 Atlas/Centaur vehicles and on seven Titan/Centaurs. Many scientific and nearly all planetary and interplanetary missions by the United States have been launched on either, or both, Atlas and Centaur. Such highly successful programs as SURVEYOR, PIONEER, OAO, MARINER, HEAO, HELIOS, VIKING and VOGAGER were launched by these systems.

This nation has launched 69 commercial communications satellites, one third of which have been on the Atlas/Centaur. At this very moment, Atlas/Centaur number 61 is poised on launch pad 36B at Cape Canaveral, ready to launch spacecraft number 6 of the INTELSAT V commercial communication satellite series on Thursday evening. This will be the twentieth consecutive launching for INTELSAT on Atlas/Centaur vehicles, beginning with the first INTELSAT IV in January 1971. In addition, Atlas/Centaur has successfully placed five military FLTSATCOM communication satellites in geosynchronous orbit.

With the advent of the Space Shuttle era, General Dynamics has continued to contribute to the United States space effort. We are proud of our role in designing and building the Mid-fuselage for the Space Shuttle Orbiter. The Mid-fuselage for OV-104, the ATLANTIS, was delivered on schedule less than two weeks ago. We are also on schedule with the modification of Centaur for use as an upper stage in the Space Shuttle for NASA planetary missions GALILEO and ISPM. In addition the DOD is jointly involved in this program and we will be providing Shuttle/Centaurs for key military missions that require high energy performance.

These comments on the background and current status of General Dynamics' participation in space programs are intended to provide some insight into the factors which have led us to today's discussions - a strong belief that there is a continuing need for the mature, proven launch vehicle systems which have performed so well over the years. What I would like to do today is to put the question of commercialization of Expendable Launch Vehicles (ELVs) into a broader context - how the commercialization of space-related activities can further enhance the United States' space prgram, national security and economy.

There appear to be three broad commercial areas where space is already, or soon will be, playing a major role. These areas are: information transfer, materials processing, and energy. In some cases, involvement either with the Space Shuttle, or possibly, permanent manned platforms. The Space Shuttle itself was envisioned from the beginning as only one element of a complete space system which includes manned space stations, orbital transfer vehicles and possibly large geosynchronous platforms.

The Space Shuttle was conceived as a reusable vehicle that could transport crews and payloads to low earth orbit. In addition to the Space Shuttle's role as an important national asset, it provides a unique capability by virtue of its very large payload capacity, on-orbit versatility and recovery agility. The presence of man increases the Space Shuttle's flexibility for mission implementation. Extra-vehicular activity, problem solving and on-orbit repair capability are significantly increased. Only a vehicle such as the Space Shuttle could make possible the prospect of convenient space station logistics support, retrieval and return to earth of low altitude spacecraft, commercially produced products such as pharmaceuticals, or valuable test samples which had been left in orbit.

As a corollary to the planned development of the Space Shuttle, the U.S. Government made a conscious decision to phase down and eventually terminate ELV programs with the expectation that the Space Shuttle would be able to handle all available traffic at a cost and schedule to satisfy all potential customers. In other words, the ELVs were destined to "go out of business" by the early 1980's.

Projected space launch traffic demands have been thoroughly examined by several U.S. Government and private groups. There is a rapidly expanding launch demand for the class of satellites particularly well suited for ELV's, the geosynchronous communication satellites. Based upon General Dynamics' continuing reviews of these various mission models and numerous discussions with both foreign and domestic users, we conservatively project the need for launch service for approximately 245 commercial communication satellites between 1986 and 1995. This market represents over $10 billion in potential launch vehicle revenue over this ten year period. Schedule flexibility and reliability are ranked more important than launch costs by most commercial communication satellite users.

When commercial communication satellite launch requirements are considered in conjunction with the planned DOD, NASA and other U.S. Government missions; the demand exceeds the supply capability of the Space Shuttle in both near and far term. This near term overflow was also projected by James E. Beggs, NASA's Administrator, during these hearings two weeks ago. This represents a classical "supply deficiency" which has always offered the private sector an incentive to participate.

The European Ariane launch system has emerged as formidable competition to U.S. systems with an advantageously sized booster system, progressive financing strategies, substantial financial backing from governments and aggressive marketing. Ariane should not be allowed to take over the ELV business unchallenged. Commercializing today's proven U.S. ELVs will provide a capability to accommodate the overflow in launch requirements in direct competition with Ariane.

Besides the obvious desire to keep America first in space as the free world's space launch source, we must also consider how a back up capability can be provided for the Space Shuttle. Our own experience over 25 years shows that unforseen delays caused by technical problems or untimely hardware anomalies can inject schedule perturbations unacceptable to either the DOD or NASA. Commercial ELVs can provide a ready source of back up.

I support the views stated by Dan Fink, Chairman of the NASA Advisory Council, in his testimony before the Subcommittee two weeks ago on the subject of ELV/Space Shuttle competition. As you recall, he noted that commercial success of the ELVs will create "some unloading of" the Space Shuttle manifest, but that this should be viewed as an encouraging event since it will open up greater opportunities for using the unique properties of the Space Shuttle: its size, the use of man, and its servicing and retrieving capabilities.

In the longer view, it would appear that the application of the Space Shuttle to those missions for which its unique capabilities are required will result in the generation of sufficient demand to fully utilize the STS Orbiter fleet. There are also certain subclasses of payloads, such as the emerging Direct Broadcast Satellites (DBS), for which adequate commercially viable, upper stages for the Space Shuttle do not currently exist. These satellites, which are too heavy for the smaller perigee kick stages currently employed with the Space Shuttle are good matches for Atlas/Centaur. Spacecraft designers have traditionally designed to utilize existing, proven launch capability.

It has also been argued that in the general spirit of free enterprise on which so much of this Nation's progress has been built, co-existence of both the Space Shuttle and U.S. ELVs will have the beneficial result of making both systems operate more competitively, and hence, more efficiently. We certainly feel that this principle will be in full force among the various ELV options which will be available in the event commercialization is permitted to proceed; indeed, we do not ask for, nor wish to see, any "favored status" of one system over another.

As I stated at the beginning of my remarks, we, at General Dynamics, have been pursuing the possibility of commercializing our current Atlas/Centaur system and derivatives for two years. In April of 1982, after one year of assessment and analysis, we expressed our interests in proceeding with such a venture in letters to both NASA and the U.S. Air Force. This was followed by a formal proposal to NASA in January, 1983, to continue the Atlas/Centaur on a commercial basis. The positive cooperation of NASA and the U.S. Air Force, as well as the encouragement we received from the State Department, OMB, and staff members of the White House has been helpful in our efforts. We also appreciate the difficulties of making this transition of valuable national assets and capabilities to the private sector and the magnitude of the effort the many U.S. Government agencies must expend in order to assure that this process is orderly and in the best interest of the United States.

What we do hope to see is a positive U.S. Government policy regarding commercialization of U.S. ELVs. If such a policy is not forthcoming in a timely manner, much of the opportunity and business incentive will pass from the U.S. to foreign interests. If private sector commercial operation does not take over the tools, facilities, and equipment used to manufacture, test, and launch the ELVs, this entire capability will be lost to the United States. The U.S. Government is already clearly on record as planning to terminate this activity. We will produce our last Atlas/Centaurs in 1985 and have already begun receiving parts from vendors for these vehicles. Vendor production lines for our system are scheduled to close down this year. In addition to the loss of these capabilities there will be substantial reductions in the work force, both for the prime producers and their suppliers. The existence of a foreign competitor will, as already demonstrated, result in American communications satellite operators electing to procure their launch services outside the United States. We in the private sector are offering to maintain, operate, and preserve this national asset at no additional cost to the U.S. Government.

Additionally, we have proposed that we reimburse the government for those added costs directly incurred in support of commercial operations from U.S. Government facilities, such as the range costs at the Eastern Space and Missile Center. While it is theoretically feasible for private operators to build and operate a luanch range independent of the current U.S. Government-owned and operated sites, this course of action would not only be prohibitively expensive but would result in the same loss of existing capability that will result if all ELV operations are terminated as planned.

We are encouraged by the recent actions of SIG Space which will soon result in issuance of a policy directive. Implementation of the policy is crucial with direction to the several U.S. Government agencies involved to take the necessary actions to make it happen, e.g., definition of range support and facility usage costs to be charged for commercial launches. A simplified regulatory process, along the lines already outlined by pending legislation, would be welcome. We do not feel, however, that any significant new U.S. Government organization or structure is required. Adequate expertise to provide the necessary management already exists in several branches of the government.

Mr. Chairman, precedents have been set for private operation of U.S. Government developed assets. This practice has been well established in the aircraft, railroad, steel and other industries. Now, we believe that there is an excellent new opportunity to encourage the "privatization" of a valuable national resource which has taken many years and many millions of dollars to develop, and thus, preserve it for long term benefit to the economy and security of our country. It is our sincere belief that the Space Shuttle and ELVs can comfortably coexist, and do so to the benefit of the nation, each providing the services for which it is best equipped. Commercialization of the ELVs by General Dynamics, and other firms, will be an important step toward a broader base of industrial space-related activity.

Mr. Chairman, we solicit the support of this Subcommittee toward these ends, and I appreciate the opportunity to present our views. I will be pleased to respond to your questions. Thank you.

W.F. Rector, III

Mr. VOLKMER. Thank you very much.

Mr. Nelson.

Mr. NELSON. If David Stockman's shop were to use commercialization of ELV's as an excuse to try to prohibit the development of a fifth orbiter and was successful in doing so, what then would be your opinion about commercialization of ELV's?

Mr. RECTOR. As I stated in the summary, we think the space shuttle has some unique capabilities. If the Nation really is to progress into the next stage of the permanent occupancy in space, which really was the birth of the shuttle back in the late 1960's, then we believe its unique capabilities would be used for that program and other things that we still don't fully appreciate. I don't believe this Nation right now knows the full potentials of the shuttle. I think the projections and statements made by previous NASA administrators indicate that we really won't know until we become operational.

Mr. NELSON. Well, does that answer mean that the Nation's prime satisfaction should be on the space shuttle and getting it operational?

Mr. RECTOR. Yes.

Mr. NELSON. And developing a fleet of orbiters adequate to serve us, whatever the needs are in the future?

Mr. RECTOR. Yes.

I think if you remember in the testimony of Jim Beggs 2 weeks ago, he did admit to an overflow problem in the near term. What we are proposing to do is to fill that overflow need by challenging the Ariane system with our existing system.

Mr. NELSON. So you see it more a United States versus European and Japanese than you see it as United States versus United States?

Mr. RECTOR. Yes, sir.

Mr. NELSON. Do you think that the chances are increased that there would not be an expansion of the orbiter fleet as a result of commercialization of ELV's?

Mr. RECTOR. No, I don't think so. I think that the mission models and our experience, especially with the commercial communications satellite people shows they underestimate their needs. They generally have acquired more launch vehicle service than they projected, and that is where the expansion is coming from, not from the U.S. Government programs, but from the commercial communications satellite business, which we think is in a tremendous expansion right now.

Mr. NELSON. Do you agree with the former witnesses as to the potentiality of setting back entry into the market of the Japanese with ELV's?

Mr. RECTOR. We really have not looked so much at the Japanese potential competition as at what we have right now, the competition we are experiencing in real time with our own system, and that is the Ariane system.

Mr. NELSON. What do you think about your competition with the Titan and the Delta?

Mr. RECTOR. Well, as the previous witnesses mentioned, there is probably a need or a use for each one of those systems. We all have different lift capabilities in geosynchronous altitude—the smallest

Delta, we are in the middle, and Titan the largest. Not everybody would fly a 747 as a commuter airline. So I think there is a place for all three of us, and could be on a commercial basis.

Mr. NELSON. Do you have anything that you would like to share with us publicly about who should be the lead agency on this move into commercial ELV's?

Mr. RECTOR. We really don't have an opinion on that.

Mr. NELSON. Maybe you can share it privately with me.

Mr. VOLKMER. If I may interject—but you would like to have a lead agency, a focal point?

Mr. RECTOR. It would help, for the same reasons given earlier, to minimize the number of people we must interact with in the Government.

Mr. VOLKMER. And I assume you would make the same statement as the other ones have. You would work with anyone, State Department, Commerce, FAA, whoever?

Mr. RECTOR. Yes.

Mr. VOLKMER. All right.

The gentleman from Florida, go ahead.

Mr. NELSON. Thank you, Mr. Chairman.

I have no further questions.

Mr. VOLKMER. The gentleman from Virginia.

Mr. BATEMAN. Thank you, Mr. Chairman.

Do we need, either under Government contract or sponsorship, or by private initiative, further research and development on expendable launch vehicles, or are we at the end of the line in that technology?

Mr. RECTOR. We are certainly not at the end of the line. I think if we transition to the commercial launch vehicle business, we should follow the same pattern as the aircraft, where the NASA has continued to do fundamental research and the commercial people have taken advantage of that as well as the military. I think it should continue on the same basis.

Mr. VOLKMER. Would you say such components as engines or parts of the engines, material used in the engines, or such things as fuels, different types of fuels?

Mr. RECTOR. I think that would be very valuable if the United States would continue doing that basic R&D. I think the same thing is happening in the commercial communications satellite business, with the work that Lewis Research is doing on the next generation of communication satellites.

Mr. VOLKMER. Mr. Bateman.

Mr. BATEMAN. Thank you, Mr. Chairman. You followed up with just what I was going to ask.

We have had references, of course, to Titan, to Atlas/Centaur, and to Delta.

They offer a range of things that would be optimal for one purpose and another for another purpose.

Is that a sufficient range of expendable launch vehicles, or is there need for larger variety that you would foresee?

Mr. RECTOR. Our market analysis shows a fairly even distribution between those three systems. Communications spacecraft are growing. Designers of communications spacecraft basically design to the available launch vehicle. They start with that.

There is a growth in the business, because the main purpose of a communications satellite is to get transponders on orbit. So the more they can get up there, on a spacecraft, the more revenue they are going to be bringing in. There will be sometimes a limitation just like we are seeing in the aircraft business, that maybe we have peaked out on the size of the airplanes and people are going back to smaller ones.

I think there will be a need to have a variety of sizes of launch vehicles for communications spacecraft for a long time.

Mr. **Bateman**. Do you foresee a short range, and if not short range, a longer term need for additional launching facilities and, in either event, do you contemplate or do you feel some of these should be turned over exclusively to the private sector for commercial launches.

Mr. **Rector**. Well, I think that, depending once again on the traffic demand, there probably are adequate facilities currently with the expendable launch vehicles. We have to satisfy the needs as we see them in the future. We are proposing just to lease those facilities and see no need to build additional ones. We think it is adequate at this point in time.

Mr. **Bateman**. How about the tooling facilities? Are these too something that would need only to be leased?

Mr. **Rector**. Yes; that is what we propose, to lease the facilities—the tools that we currently use to build the Atlas and Centaur.

Mr. **Bateman**. In terms of launch site facilities, how many do we have?

I ought to know that, but since I don't, I have to ask.

Mr. **Rector**. Well, totally, I cannot give you the number for all expendable launch vehicles. We have two Atlas/Centaur pads at Cape Canaveral. We have two Atlas launch pads at Vandenberg, although in the past we have had as many as 15 total between the two locations. A lot have been deactivated over the years.

Mr. **Bateman**. There then are only two that are utilized for purposes of the Atlas/Centaur launches?

Mr. **Rector**. Yes.

Mr. **Bateman**. How about my facility at Wallops Island, on the Eastern Shore of Virginia? Do you launch anything there?

Mr. **Rector**. No; only the Scout, to my knowledge, is launched from there.

Mr. **Bateman**. I believe that is all I have, Mr. Chairman.

Mr. **Volkmer**. Thank you very much.

I have several questions.

In your testimony you did not give a lot of emphasis to your bid on Intelsat VI. I get the impression that in the event you were not successful in that, you would still proceed with the commercialization of the Atlas.

Mr. **Rector**. Well, the Atlas/Centaur I referred to in the testimony is the current Atlas/Centaur system. The Atlas/Centaur system that we had proposed to do the Intelsat VI mission has twice the performance capability of today's Atlas/Centaur.

This would require an investment on our part to increase the size of the Atlas, and the main reason we did not submit our final bid to Intelsat on May 11 was because there was not a U.S. space policy where we could even go ahead with commercial expendable launch vehicles, and the uncertainties associated with that. We did not feel we could turn in a fixed-price proposal to provide that service, with that uncertainty.

This does not mean we will not continue our efforts to bring a derivative of the Atlas/Centaur system into the inventory if it make sense from a market standpoint.

Mr. **Volkmer**. My question is: You are still interested in the commercialization, even without that?

Mr. **Rector**. Yes; we are interested in commercializing today's Atlas/Centaur because our assessment of the market is that there are 65 potential opportunities out there for today's Atlas/Centaur, and that is the market that we are interested in.

Mr. **Volkmer**. The time frame that I get from the submitted testimony is that you don't have a long time to make that decision, is that correct? Because some of the vendors supplying the parts for the Atlas/Centaurs are already shutting down, is that correct?

Mr. **Rector**. Yes; we currently are receiving parts from our vendors for the last Atlas/Centaurs that we will be finally producing in 1985. There is generally a 3-year lead time. So we are receiving those parts. And if we do not continue with the Atlas/Centaur system, those people will not be in business for our system.

Mr. **Volkmer**. So you would have additional costs? What are you looking at as a timeframe to make a decision on go-ahead as far as commercialization is concerned?

Mr. **Rector**. We have made a decision that if the policy is favorable, agreements can be implemented, we will proceed. So we are in a go mode as far as our company is concerned. And of course the most important thing to get accomplished is how quickly we can get these agreements implemented.

Mr. **Volkmer**. When do you hope to have those? June, July, August?

Mr. **Rector**. We would prefer getting them by the summer, and no later than the end of the year. Then it will be a very serious problem for us.

Mr. **Volkmer**. Does General Dynamics have any thoughts on seeking the commercialization of the wide-bodied Centaur as an alternative to other shuttle upper stages now in development?

Mr. **Rector**. The shuttle and Centaur that we are currently developing for the NASA and DOD has about five times the performance of today's Atlas/Centaur. We think it will be no earlier than the 1990's that the commercial communications satellite business will transition to that size of vehicle.

We may be talking about Intelsat VII, which Intelsat talks about in the 1992–93 time period. So depending on how quickly the commercial communications satellite market moves into the larger sized vehicle, of course we would be willing to provide that system on a commercial basis.

Mr. **Volkmer**. And again, you do not see the Atlas/Centaur as competitive with the shuttle, but as more of a competitor to the Ariane, is that correct?

Mr. **Rector**. We would like to go win some of the systems back that we have lost from our system, because the users were definitely under the opinion that the Atlas/Centaur would not be available after 1981. So, therefore, our biggest competition is the Ariane. It has a one-to-one capability to our system—Intelsat V is a good example.

Ariane III provides exactly the capability of the Atlas/Centaur. What we are trying to do is go back and compete with that system.

Mr. VOLKMER. Now, you will be providing your own insurance liability, right? Hold the Government harmless?

Mr. RECTOR. Yes, that has been worked out.

Mr. VOLKMER. Do you have an opinion on launch licenses, once we get into commercialization. Should that cover each individual launch, should you have to come back, or be able to do it under a license for a year depending on approval of payload and that type of thing?

Mr. RECTOR. We are proposing a system which has a specific capability, so we would be looking for a license for the Atlas/Centaur system. If we went forward with a derivative, then of course we would get a license for that. But right now we think a license renewable once a year would be appropriate.

Mr. VOLKMER. Would you be basically looking at communications satellites?

Mr. RECTOR. Yes; that is the main thrust of our commercial efforts.

Mr. VOLKMER. And you don't believe, then, that each payload that you have should be approved by the Government?

Mr. RECTOR. No.

Mr. VOLKMER. Does the gentleman from Florida have any further questions?

Mr. NELSON. Yes, Mr. Chairman.

I just wanted to ask, how many Atlas/Centaurs do you have in the pipeline for production through what year?

Mr. RECTOR. We currently have—just removing the one that hopefully will launch tomorrow night—we have seven more on contract, four to be provided for Intelsat V's, and three for the Fleetsatcom, which is the military communications satellite.

The last ones are produced in 1985. But the Fleetsatcom will be launched—one in 1985, one in 1986, one in 1987. We will have it built in 1985, and have all of them launched by 1987.

Mr. NELSON. So if you did not proceed with commercialization, you would have to shut down your production line when?

Mr. RECTOR. 1985.

Mr. NELSON. Thank you.

Mr. VOLKMER. The gentleman from California?

Mr. LOWERY. Thank you, Mr. Chairman.

It is a great day, I think, with the President's announcement on Monday, at least for General Dynamics Convair division.

Could you amplify a little bit. You mentioned the shuttle and Centaurs will have five times the performance of the current Atlas/Centaur. You are referring to a launch from the shuttle up at about 100, 115 miles, are you not?

Mr. RECTOR. What I am talking about is the size of the spacecraft that we would deliver to geosynchronous orbit—on today's Atlas/Centaur, the weight of the spacecraft that finally gets on orbit is about 2,500 pounds. The weight of the smallest spacecraft we would put up with the shuttle and Centaur is 10,000 pounds. With the larger version it is close to 15,000 pounds. It is quite a gap between the two systems.

Mr. LOWERY. Could you amplify on the competition with Ariane? Are we locked in on those future Intelsat launches or is there opportunity for U.S. firms to go back?

Mr. RECTOR. Well, I think that we were strongly encouraged by the Intelsat people to enter into the expendable launch vehicle possibilities for Intelsat VI. And there were specific reasons for that.

When they started with the development of Intelsat VI with Hughes, the Ariane had just had a failure and the shuttle had yet to fly. There were some uncertainties in their mind. They felt they should always have two available launch vehicles, one would be the shuttle and then an expendable. The Ariane is still a question mark in terms—in its early development phases, like we were in the 1950's. It still has a way to go to get to the Intelsat VI capability.

So we feel that there is room for other expendables, other than Ariane.

Mr. LOWERY. Like an Atlas/Centaur.

What are the costs to the taxpayer?

Mr. RECTOR. Right now there is no proposed cost. In fact, they think there would be a savings. In the near term the savings would be in the range cost. The range costs so much to operate, no matter how many vehicles are launched. In fact, the cost to the users nowadays is based upon the number of launches per year, and they divide that into the cost of operating the range. The commercial flights added to that will reduce the cost to the Government for operating that range. In the long term, we think there will be a cost avoidance.

Typically, what happens with our Atlas pads at the Cape, when they are mothballed, they are mothballed. Stands are taken down, the launch pad is basically taken down to the concrete. If it ever has to be brought back on line, it is quite expensive. We are proposing to maintain that facility in readiness, and if there is a national security need or any other Government needs for the use of those facilities, they have top priority. That is what we said in our proposals to NASA

Mr. LOWERY. Are there ways in which the shuttle program might benefit from commercialization of ELV's?

Mr. RECTOR. Yes; I think the most significant thing is it would free the shuttle up to be used for its unique capabilities. Instead of using it for very short duration, expensive launches to put up satellites, it could stay in orbit for longer durations and be the beginning of, for example, going towards permanent occupancy of space. And also, it has a unique capability to do R&D work in that we can take hardware up into orbit and try out concepts, devices. Sometimes we have lost the complete mission because of a mechanical failure of a piece—we can take up these as experiments on the shuttle and actually test out the component before it is committed to an operational system.

You cannot do that with an expendable launch vehicle. But the shuttle has that capability.

Mr. LOWERY. What are the national security implications of maintaining commercial expendable launch vehicles?

Mr. **Rector**. I think it would provide the backup capability for using those systems designed to be used on either the expendable or the shuttle—our derivatives have been designed so our system would be compatible with the shuttle. We would have a large enough diameter so that a payload could either fly on the shuttle or our derivative expendable launcher. So it would provide that backup capability in case of the fleet being down or some important need.

Mr. **Lowery**. Any particular skills or technologies you are looking to, to market for commercialization of ELV's, other than communications satellites?

Mr. **Rector**. No; basically what we would be looking for, if the expendables are taken out of the inventory, is that capability for building Delta, Titan, and Atlas/Centaurs, going back 25 years. And that skill will go to other programs. It would be hard to bring it back on line. We are talking about the engineers and the people.

Mr. **Lowery**. If you closed down your line, it would be virtually impossible to put the team back together.

Mr. **Rector**. Yes.

Mr. **Lowery**. Could you comment on the President's policy more fully.

Mr. **Rector**. I think it is very good. I think it is a positive step. I think it gives the basis to proceed.

I think the important thing that I tried to emphasize in the written statement, my oral statement, is that we hope the implementation of that policy is done in an expedient manner so that we can get on with the competition.

Mr. **Lowery**. Very good.

Thank you, Mr. Chairman.

Mr. **Volkmer** Thank you.

I have one last question.

In your statement you say that a simplified regulatory process along the lines already outlined in pending legislation would be welcome. Is that the Akaka bill?

Mr. **Rector**. We really take no position on whether there is adequate legislation or not, because we have not gotten our lawyers to look that closely at it. But we are really looking for a simplified regulatory procedure more than anything else.

Mr. **Volkmer** Not additional regulations or anything, but a simplified method of one stop, go to one place, and find out everything you have to do. Licensing—instead of having a license for each one, maybe like you say for the whole Atlas/Centaur range of operations, that type of thing.

Mr. **Rector**. Yes, I think the experience with SSI last year to launching their first commercial launch vehicle proves that point. It was very difficult for them to get all of the loops closed with all the different agencies. It was a very time-consuming process. I think it would minimize that if you could pull that together.

Mr. **Volkmer**. Thank you very much.

Our last witness is James C. Bennett, vice president for Government Affairs, Arc Technologies.

Your statement will be made a part of the record.

STATEMENT OF JAMES C. BENNETT, VICE PRESIDENT FOR GOVERNMENT AFFAIRS, ARC TECHNOLOGIES, REDWOOD CITY, CALIF.

Mr. BENNETT. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I would like to begin by expressing on behalf of Arc Technologies, its chairman, Mr. Philip Salin, and its president, Michael Scott, as well as myself, our gratitude for this opportunity to introduce our company to you this afternoon.

Arc is very encouraged by the timely interest shown by the committee in what is a new and rapidly accelerating commercial sector, industrialization of space.

At this point, I would like to summarize my testimony and, then, share some of the thoughts which have occurred to me over this day and the previous day in this committee room.

I was noticing, as I heard the statements of the previous witnesses, an interesting pattern.

In the pictures on the walls of this committee room, we see around us the evidence of a whole generation of very exciting, very bold enterprises in space, carried out by the strong leadership of NASA. This is a generation of accomplishment and achievement which has made the whole world sit up and take notice of what Americans can do.

I think that what we have been hearing in the last 2 days represents the next generation, a new level of activity by Americans in space and one that I believe if it is allowed to develop freely is going to equally astound the world with its own accomplishments.

We have seen a very interesting range of ventures discussed and proposed in the prior testimony, and in the testimony in prior weeks here. They represent a very interesting spread of ventures which are basically talking about taking a segment of existing Government activity into space and financing it privately, marketing it privately, mating privately developed hardware to Government systems, and systems where you are talking about acquiring Government developed technology and operating it on a private basis.

We believe that Arc Technologies represents in a sense one end of the spectrum, and that is what I am going to try to acquaint the committee with today in my remarks.

We are at the end of a spectrum in the sense that we are a venture which seeks to provide space transportation on what we describe as an entirely private basis.

In other words, we are a company entirely privately financed. We will develop our technology privately through our own financing, through our own technological means. We will build our vehicles ourselves and operate them ourselves, selling only the service to all legitimate customers, United States and international.

To this extent, we see ourselves as an ordinary commercial entity providing service to customers in exactly the way any other privately financed, privately developed venture in this country does. We feel that our relation to the Government should be basically that of any other entity interacting with the Government only in the regulatory sense—when there are valid public concerns, such as public safety or national security.

Our business plan does not depend on specific arrangements with the Government. We do not depend on being able to acquire Government hardware, facilities, or services at any particular price. We carry the option of providing all of the necessary services for space launch and operations ourselves, and, as such, I think we are more independent of public policy decisions than any other venture in this area.

Arc Technologies began in the beginning of 1981 with a group of people in the San Francisco Bay area that had both an interest in development of private commercial activities in space and an interest in the way the entrepreneurial approaches which characterized the electronics industry in the bay area and characterized some other starting high technology ventures, such as the biotechnology industry, make use of certain financial, organizational developmental approaches. We felt that these approaches can and ought to be applied to the development of space transportation.

So this is the sort of venture we outlined. This is the venture that we raised money for from the American venture capital community, and this is the mode by which we intend to develop and operate our vehicles.

We are in the process of deciding how to approach the problem of space transporation. We have chosen to use several interesting technologies which were developed in the public domain back in the 1960's. We are using an engine technology known as the hybrid, which uses a solid fuel core and a liquid oxidizer, in this case liquid oxygen, combining and burning them in a way which is unique to the hybrid system and dissimilar to both liquid and solid propellants which we have heard much more about.

We have also chosen to use a launch technique in which the rocket is launched directly from the surface of the water, including the capability of launching from the open seas.

We have chosen that method because of its certain advantages in public safety. It allows us to launch initial test rockets away from even the remotest possibility of impact on an inhabited or populated area, as well as away from air and sea traffic lanes.

It also gives us the ability to launch from any point on the ocean surface, which will make us the only American company which can launch from the Equator directly into equatorial orbit without having to use a foreign territory launch site.

This is a U.S. company, funded by U.S. nationals entirely and intends to operate under the laws of the United States and under its jurisdiction.

We are under U.S. jurisdiction when operating in international waters exactly the way a U.S. airline is when its planes are abroad, or a U.S. shipping entity when its vessels are on the high seas.

So, we retain our commitment to full American supervision of our activities.

We feel that this approach, which is now under development, will allow us to create an independent technological road to space capacity, one which has a number of interesting and unique characteristics, and which, taken in toto, will augment the U.S. ability to operate in space, and, I might add, without a direct drain on the public treasury.

In terms of specific activities, we spent the first year gathering together the team to work on this, including our initial employees, doing proof-of-concept tests, and obtaining capital funding. The second year has been spent on our technology development program, concentrating on vehicle propulsion and guidance.

We have conducted over 10 tests of our engine type, including a full-scale hybrid engine of 25,000 pounds' thrust, successful full-length burn, and this is carried out under the direction of the propulsion team we acquired in the course of building up our team.

We chose to bring into the company experienced professionals from all sectors of the aerospace industry, starting with our president, former president of Apple Computers, formerly vice president for manufacturing, National Semi Conductor, and our propulsion staff, which came primarily from the Chemical Systems Division of United Technologies Corp., where they had senior development responsibility; guidance and control from Lockheed Space and Missiles Corp.; and other management staff from aerospace, and in our general middle-level technical staff that has experience from many of the aerospace institutions in the United States.

We feel we have, more than any other new private entity in this area, created a new team with its own independent design operational capabilities. We expect to have the first suborbital test for a rocket system this year, hopefully in the late summer, early fall.

This would be a suborbital shot carried out from the Pacific Ocean, over 200 miles from the coast of California, beyond range of land, at the maximum possible range, go up 100 miles into outer space and return within 10 miles of the launch point. And this will serve primarily as a propulsion test bed and then as a guidance and control test bed for our systems.

We then intend to go from a suborbital rocket development program to an orbit launch system and from there to eventually acquire a geosynchronous satellite placement capability.

We expect a fairly rapid development due to the fact that our technology development program was designed from the start to end up at our goal of geosynchronous capability.

And the technologies we have chosen are all capable of fairly rapid development, once we have started this.

Last summer, Arc initiated a low key approach to acquainting officials with our company's background and goals. These discussions, which involved officials in the White House, State Department, NASA, FAA, gave both the agencies and Arc a chance to explore the various issues generated by our venture.

We are happy to report that so far all of our discussions and dealings with the agencies have been conducted in a spirit of mutual cooperation and encouragement. NASA Administrator, James Beggs, one of the first officials we briefed on our plans, set the tone for our subsequent talks with the Government by offering his support and saying, "Welcome to the club." We did appreciate that spirit at NASA, and a similar spirit we have encountered at the other agencies.

Arc is in the midst of a governmental review of its request to launch and thus lacks sufficient information to make specific comments on the impact, adverse or otherwise, of regulations and agencies on private launch activities. Instead, we would like to provide a brief overview of the steps Arc is taking to obtain approval of its launch. We would then like to bring to the committee's attention some general characteristics of a launch approval process whose incorporation would greatly assist in encouraging commercial space activities.

We are under the basic jurisdiction of the Department of State in this matter. We are required to get an export permit, temporary export permit, from the Office of Munitions Control of that agency. Since State does not have the in-house capability to judge the public safety aspects of the launch, it was referred for comment to NASA, FAA, and the Department of Defense. There, we are undergoing a safety review through NASA and the FAA, and we are expecting comments to be returned to the State Department fairly soon, and on that basis the export permit can be issued.

We also have a permit for the use of the radio frequencies on the part of the FCC; since they have channels in which to deal with developmental permits of this sort, it is not considered to be an extraordinary matter.

Although our view may change as we continue to seek an export license to launch, it appears that this approach will achieve launch approval as long as the operator is in a development, prototype stage. However, in order for investors and customers to have faith in the availability and predictability of private space transportation, a long-term regulatory structure oriented to commercial business practices must evolve. Although it is too early for us to define exactly what that system ought to be, we can make a number of general observations and recommendations:

First and foremost, the regulation of commercial space activities should be kept at the bare minimum required to meet public safety/national security objectives;

The Federal Government should reaffirm its commitment concerning the private sector's right to pursue activities in space and should support an even-handed approach to defining impartial, nonburdensome standards for meeting its concerns.

We were very encouraged by the President's policy statement as of Monday, and we are now primarily interested in seeing that the spirit of that statement does get carried accurately into the reality of the regulations that result from it. As Mr. Walker commented yesterday, administrations come and go, but civil servants do remain in town. We would hope that strong scrutiny and oversight by both the administration and the legislative branch would continue in order to assure that the goals set forth in that statement do get turned into the reality of regulation.

We feel that launch service operators should not be required to undergo redundant permit review processes. For example, an operator should not be mandated to go through an export license review if another procedure for accomplishing the same goal has been established.

The Government should avoid subsidizing, or in any way unfairly supporting, one launch operator against another.

The Government should not impose inflexible means for meeting public safety standards, especially when dealing with different types of launch technology. Nor should national range standards be automatically and universally applied to different launch operators.

We feel there is a potential for unintended economic regulation to sneak in the back door via safety standards if there is not close scrutiny as to the actual effect of proposed safety standards.

In its deliberations on public policy in this area, the government should recognize that it can offer no more than an interim solution to coordinating private-launch activities. Any long-term approaches—for example, designating a permanent lead agency and setting long-term safety and security criteria—can only be developed in the light of growing operational experience.

In our view, the following characteristics should be incorporated into any Government involvement in the commercial launch business:

The lead agency should have a mandate to promote space industry, as well as protect the public interest. If it rejects a launch permit request, it should be constrained to offer reasonable alternative approaches to obtaining approval;

It should be granted real preemptive powers to make decisions. To expedite the process and, thereby, protect all parties involved in the approval process, the Federal Government should seek to preempt State laws which might divide or dilute the lead agency's authority;

Any regime overseeing private launches should be flexible enough to permit innovative approaches to meeting safety standards. For example, the Government could set the basic safety standards with an understanding that launch operators have the resident expertise to carry out their own range safety review. It is our belief that the requirement for insurance coverage—to a level set by the Government—would provide an incentive for operators to satisfy public safety concerns;

Any attempt by the Government to define safety standards should be based on the extent to which a launch activity poses an undue risk to persons and property not directly involved in the operations. This scrutiny should be related to the potential risk represented by the operator's particular launch technology, where the launch takes place, and so on. In this regard, mandatory insurance requirements should not be uniform;

The costs to the launch operator for meeting launch permit review requirements ought not to be unduly burdensome.

Arc Technologies is part of a growing number of entrepreneurs who have amassed the capital and talent necessary to undertake the risks associated with commercial space development. To date, the Federal Government has been most cooperative and supportive in our efforts to obtain permission to demonstrate our launch technology. However, if routine, commercial space transportation operations are ever to become established, the Government must create an environment which fosters this nascent business rather than impedes or stifles it. We have suggested ways in which the Government's launch approval process might be made more sensitive to the pressing needs of commercial space transportation operators for certainty and predictability.

I would like to conclude by saying at the start of every era, when a new high technology industry begins to emerge, there are critical regulatory decisions which are made, and, once made, tend to remain in force and shape very significantly the emergence of that industry.

If we look back to the experience of the 1920's and 1930's, when aviation, when radio communications technology emerged, the decisions made in the 1920's and 1930's, by Secretary Hoover, under President Coolidge, led to the establishment of the FCC, FAA, and CAB. These have had a substantial effect on the structure of the industry.

Far-reaching decisions to change some of the regulatory structure, particularly in the aviation industry, have caused a lot of vast changes which have been characterized by many people as dislocations.

I urge the committee, I urge Congress, to examine very carefully the effect of any particular regulatory structure which you propose.

Thank you very much.

[The prepared statement of Mr. Bennett follows:]

May 18, 1983

STATEMENT OF

JAMES C. BENNETT
Vice-President of Government Affairs
Arc Technologies

before the

SUBCOMMITTEE ON SPACE SCIENCE AND APPLICATIONS

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

Mr. Chairman and Members of the Subcommittee:

I would like to begin by expressing on behalf of Arc Technologies and its president, Mr. Michael Scott, our gratitude for this opportunity to introduce our company to you this afternoon. Arc is very encouraged by the timely interest shown by the Committee in what is a new and rapidly accelerating commercial sector, the industrialization of space.

We trust this hearing will be one of many exchanges between this Committee and new enterprises, such as Arc, in order to better explore the ways in which governmental policy can encourage more American activity in this high-risk but increasingly vital growth area.

It is our perception that space development is in the midst of a transition from an experimental and exploratory phase to an era in which more and more activity is undertaken on a commercial basis. Policy decisions made now by the federal government will impact this process, either positively or negatively.

Arc Technologies has held from its beginning that this transitional period can be facilitated by a Federal policy based on the principle of competitive privatization: the substitution of competitive privately-financed activities for governmental activities whenever possible; and allowing the market to guide decisions currently made by government fiat.

The government has a valid, indeed, necessary interest in this area. However, instead of direct government involvement, what is required is a reaffirmation of the principle that the civilian space arena has been unequivocally opened to commercial activities. As a result, current involvement of private investors in areas such as space transportation, remote sensing, space industrial research, and advanced space-based communications will broaden into significant investment and entrepreneurial innovation. Once the government stands back and declares space open to business, our own activities will be testimony to the tremendous American entrepreneurial spirit of innovation (unequalled in the world) ready and eager to take on the foreign challenge in space.

As the field matures, space activity will separate into civilian space research and science, purely commercial activities, and defense spheres with activities carried out in each by appropriate sectors: a strong NASA dedicated to leadership in space science and exploration, a strong private sector seizing leadership in space commercialization and transportation, and a strong national security effort.

Arc believes that this emergence of market-driven decisions in the field of space transportation is the key to the development of a diverse, readily available, commercially oriented transportation segment in America's space arena. Arc expects to create its market niche in this area by developing and operating targetted transportation services developed to meet the special needs of customers.

We expect to derive cost-effectiveness through flexible and short turn-around decision-making, as well as some of the financing and marketing approaches common to other American high-technology entrepreneurial industries. This market-oriented, customer-sensitive approach, combined with reduced prices, can be expected to create a new level of demand and use of space by American industry across the board. To fill the void for a launch system tailored to meet the needs of customers, Arc went back to the drawing-board to design a new system intended to avoid the high labor, material, and capital costs associated with today's launchers which are oriented to military, manned, and exotic reseach missions.

Although its particular service may appear futuristic, Arc believes that its approach is very much within the renowed American tradition of entrepreneurial innovation. As shown by the range of witnesses who have appeared before this Committee, there is a growing community of private space firms eager to offer an entrepreneurial response to maintain this nation's preeminence in space technology.

The pressing need now is not for the commitment of large amounts of government funds in transportation or industrialization; rather the call is for private risk and reward through a policy committed to a clear mandate for private action in space. In so doing, business will look to government to keep regulations at the minumum needed to meet public security/national security objectives.

Arc Technologies was founded in early 1981 by a group of entrepreneurs in the San Francisco Bay Area with the goal of offering a variety of commercially financed and developed launch services. The company was founded with the view that the financial and business approaches which have proven so successful in the electronics industry, and which are now extending to biotechnology, can be applied to space development.

Over the past two years, Arc has worked at its business and technology development strategy, raised sufficient funding for its initial launch activities, and increased its staff to the level necessary for its current activity. We have brought on board senior management personnel, including Arc's President, Michael Scott, formerly president of Apple Computer, and other senior management and technical personnel from United Technologies, Lockheed, Ford Aerospace, and other well-established aerospace firms.

Arc expects to succeed in this business by selecting the most cost-effective technical approaches rather than the most performance efficient technical approaches. By innovatively selecting alternative technical approaches with modestly lower technical performance, Arc expects to eliminate categories of cost and risk which are unavoidable using traditional launch technologies. Essentially, Arc will introduce a 'Mack truck' level of performance in space, rather than the current 'Porsche' level of technical efficiency. This emphasis on economic efficiency, rather than aiming for the limit of technical possibility, will enable Arc to achieve a high level of reliability quickly, with low development risk and at relatively low development cost.

Drawing on currently available technology, Arc is designing, assembling and fabricating its vehicles in house. We are employing aerospace subcontractors only for selected components and subassembly. We intend to rely as much as possible on commercial standards of operation and commercial business practices.

We have successfully conducted propulsion tests of engines of our own design and manufacture, including full scale flight-size engines, and have worked on the marketing, regulatory, legal and other aspects of this business.

Our development schedule calls for a flight test of our launch vehicle this year. Following the conclusion of flight testing, Arc will offer a sounding rocket_*/service on a commercial basis. Our long term objective, proceeding from a systematic effort to match our technology to meet changing customer needs, is to develop a launch system with orbital capability.

_*/Sounding rockets are used for investigations in, among other areas, astrophysics and microgravity processing research. They carry packages of scientific instruments and experiments to altitudes from twenty to a thousand or so miles. A sounding rocket's effective lifetime until it drops back to Earth usually lasts no longer than several minutes. Its advantages to scientific and industrial users are several. It is the only vehicle which can perform investigations in the region from 30 to 100 miles above the Earth. Balloons cannot carry equipment above 30 miles and satellites are generally impractical to use below altitudes of 100 miles due to atmospheric drag. Above all, the relative ease (cont. on page 5).

Although based on existing knowledge and materials, Arc's launch system has several innovative features. One of the more prominent of these is that the vehicle will be launched directly from the open seas. In fact, our test launch will be off the California coast. In order to minimize the risk from launch activities, it is probable that the launch site will be 200 miles or more out in the Pacific. The initial test vehicle, designated the 'Dolphin', will achieve an approximate altitude of 100 miles and a downrange trajectory of about 10 miles.

This test launcher will not be carrying a payload. We intend to recover both the booster and payload bay, which will be landed by parachute, retrieved and carried back to harbor for refurbishment.

Among other objectives, this flight test will demonstrate our operational capability: to take from the drafting board to development a privately financed and designed rocket, launch and recover it. A critical objective is to strive for a cooperative relationship with the appropriate government agency officials and, thereby, lay the basis for a launch permit review process which will accomodate the need for certainty and predictability required by investors and customers in routine commercial operations.

In the interests of achieving such a relationship with the government, last summer Arc initiated a low-key approach to acquainting officials with our company's background and goals. These discussions, which involved officials in the White House, State Department, Defense Department, NASA and FAA gave both the agencies and Arc a chance to explore the various issues generated by our business venture prior to actually seeking the government's approval to launch.

We are happy to report that so far all of our discussions and dealings with the agencies have been conducted in a spirit of mutual cooperation and encouragement. NASA Administrator, James Beggs, one of the first officials we briefed on our plans, set the tone for our subsequent talks with the government by offering his support and saying, 'Welcome to the club.' /1

_*/(cont. from page 4)of launch and payload recovery operations give the user flexibility in terms of conducting an experiment at the time and place preferred.

Arc is in the midst of a governmental review of its request to launch and, thus, lacks sufficient information to make specific comments on the impact, adverse or otherwise, of regulations and agencies on private launch activities. Instead, we would like to provide a brief overview of the steps Arc is taking to obtain approval of its launch. We would then like to bring to the Committee's attention some general characteristics of a launch approval process whose incorporation would greatly assist in encouraging commercial space activities.

As a result of Arc's intention to move its launch vehicle from U.S. territory and launch it from the high seas, the company is required to obtain a temporary export license (under the Arms Export Control Act) from the Department of State's Office of Munitions Control (O.M.C.).**/ Because of the liability assumed by the U.S. in the event of damage to third parties (under the Outer Space Treaty and the Convention on the International Liability for Damage Caused by Space Objects), the Department of State has requested that launch operators obtain adequate insurance and agree to indemnify the U.S. for any damages that may result. In this regard, Arc is currently negotiating with a leading insurance broker for the necessary coverage.

Also, Arc intends to initiate the procedures for the issuance of notices to mariners and airmen, and has discussed with the Department of Defense procedures for DOD officials to be given prior notice of our flight testing.

To satisfy itself that Arc's launch procedures and operations do not pose undue risks to persons and property not directly involved in the launch activities, O.M.C. has referred our application to DOD, NASA and FAA for their technical input. During the past several months, we provided technical briefings to these agencies on our systems and launch plans. After completing their evaluations, the agencies will report back to O.M.C. with their comments. O.M.C. will then render its decision.

Although our view may change as we continue to seek an export license to launch, it appears that this approach will achieve launch approval as long as the operator is in a development, prototype stage. However, in order for investors and customers to have faith in the availability and predictability of private space

---

**/Also, the State Department has defined a launch per se as an export activity.

transportation, a long term regulatory structure oriented to commercial business practices must evolve. Although it is too early for us to define exactly what that system ought to be, we can make a number of general observations and recommendations:

- first and foremost, the regulation of commercial space activities should be kept at the bare minimum required to meet public safety/national security objectives;
- the federal government should reaffirm its commitment concerning the private sector's right to pursue activities in space and should support an even-handed approach to defining impartial, non-burdensome standards for meeting its concerns;
- launch service operators should not be required to undergo redundant permit review processes. E.g., an operator should not be mandated to go through an export license review if another procedure for accomplishing the same goal has been established;
- the government should avoid subsidizing, or in anyway unfairly supporting, one launch operator against another;
- the government should not impose inflexible means for meeting public safety standards, especially when dealing with different types of launch technology. Nor should national range standards be automatically and universally applied to different launch operators;
- in its deliberations on public policy in this area, the government should recognize that it can offer no more than an interim solution to coordinating private launch activities. Any long term approaches (e.g., designating a permanent lead agency and setting long term safety and security criteria) can only be developed in the light of growing operational experience.

In our view, the following characteristics should be incorporated into any government involvement in the commercial launch business:

- the lead agency should have a mandate to promote space industry, as well as protect the public interest. If it rejects a launch permit request, it should be constrained to offer reasonable alternative approaches to obtaining approval;
- it should be granted real preemptive powers to make decisions. To expedite the process and, thereby, protect all parties involved in the approval process, the federal government should seek to preempt state laws which might divide or dilute the lead agency's authority;
- any regime overseeing private launches should be flexible enough to permit innovative approaches to meeting safety standards. E.g., the government could set the basic safety standards with an understanding that launch operators have the resident expertise to carry-out their own range safety review. It is our belief that the requirement for insurance coverage (to a level set by the government) would provide an incentive for operators to satisfy public safety concerns;
- any attempt by the government to define safety standards should be based on the extent to which a launch activity poses an undue risk to persons and property not directly involved in the operations. This scrutiny should be related to the potential risk represented by the operator's particular launch technology, where the launch takes place, and so on. In this regard, mandatory insurance requirements should not be uniform;
- the costs to the launch operator for meeting launch permit review requirements ought not to be unduly burdensome.

In summary, Arc Technologies is part of a growing number of entrepreneurs who have amassed the capital and talent necessary to undertake the risks associated with commercial space development. To date, the federal government has been most cooperative and supportive in our efforts to obtain permission to demonstrate our launch technology. However, if routine, commercial space transportation operations are ever to become established, the government must create an environment which fosters this nascent business rather than impedes or stifles it. We have suggested ways in which the government's launch approval process might be made more sensitive to the pressing needs of commercial space transportation operators for certainty and predictability.

To assist the Committee in its deliberations in this public policy area, Arc will be happy to keep you informed of our progress as we continue to seek approval for our demonstration launch this year.

At this point, I will try to answer any questions that you may have.

Mr. Volkmer. Thank you very much, Mr. Bennett. I appreciate your testimony here today.

I would like to go through several questions here. First, I would like to know, how did you, Arc Technologies, arrive at the conclusion that there is a market for your launch vehicles. Considering what you have heard today: the Atlas Centaur, the Titan; we know we have the shuttle, and then we have the IUS; I hope it works in the future. Also the Centaur for heavier loads, and the PAM-A and PAM-D, and we have, coming, a TOS for heavier loads. Faced with all this, how do you come to the conclusion there is room there for you?

Mr. Bennett. Well, Mr. Chairman, first of all, we analyzed the market at the beginning of the planning period for the venture, and we did feel that even at current terms of cost and availability, that there would be an excess of demand over supply in the international satellite market through the 1980's.

Of course, given this perception of demand, there have been a number of attempts from different corners of the industry to come and meet it. That is a lot of what we have heard today. However, we feel that our strategy of new technology development, and an entrepreneurial level of activity, are going to give us advantages. Our technology will give us certain advantages in terms of service flexibility and availability, not to mention cost competitiveness, which will allow us to capture a viable segment of the market.

Mr. Volkmer. But you will have the problem with reliability at first, will you not, on your first, second, and third, as against the Atlas and the shuttle, the Titan, the Delta?

Mr. Bennett. Certainly the first several flights will be in the nature of demonstration flights and development flights. Of course, we hope to, by setting a good record in these flights, begin convincing potential customers of reliability.

I would like to just venture the observation that I think our first five flights of our communications satellite launcher will present a record of reliability equal to or better than the Ariane.

Mr. VOLKMER. I am not trying to dissuade you. I am just trying to see——

Mr. BENNETT. We are very aware of that. We do hope, by undertaking demonstration flights, to convince the customers of the reliability of the system.

Mr. VOLKMER. When you started out for the venture capital, how did the people that you talked to react to your ideas?

Mr. BENNETT. Well, sir, we had a widely varied reaction from the venture capital community. But one of the characteristics of the high-technology-oriented venture capital community is that they are willing to listen to almost any business proposal provided that you can show that there is a market, that it is technologically feasible, and that the business has the capability of accomplishing the job or recruiting additional people who will accomplish the job.

And we did find a number of people from that community who listened to us, who paid attention to our market, and saw a future in it and took a risk according to that. To a large extent, we did have to do some education of the venture capital community in our area about space and the potential for space development.

Mr. VOLKMER. You did not have any great difficulty? Did you have to give them a risk analysis?

Mr. BENNETT. Certainly—any responsible venture capital group or individual in this sort of industry goes over a proposal with a fine-tooth comb and submits the plans to analysis by a number of independent evaluators.

We certainly had to go through this process a number of times.

Mr. VOLKMER. When did you first talk to NASA, to Mr. Beggs? When was that?

Mr. BENNETT. That was last summer, I believe, in early July.

Mr. VOLKMER. When did you first start with the idea of licensing?

Mr. BENNETT. Pursuing a launch permit?

Mr. VOLKMER. Yes.

Mr. BENNETT. Of course, we understood from the onset of the company that there would be a Government supervision and licensing process. We were not actually aware at the time we first planned the venture exactly which route it would take, because, as you remember, the field was entirely new then.

There was no particular knowledge on the part of the Government how they would be able to license this. The pathfinding done by Space Services, Inc., of America, in their Conestoga launch, was partially helpful, but not entirely, since they launched from the United States, whereas we launch beyond the limits, and our primary governing document is the Department of State temporary export permit.

To answer your question, in our initial discussions with Mr. Beggs, with State Department officials, with FAA officials, and other people, we just went to every agency which we thought might conceivably be involved and discussed it with all of them.

And through analysis by our attorneys and working with the attorneys at various agencies, it was determined that the primary means of Government oversight of our activities would be the State Department's Office of Munitions Control, a situation deriving from the fact that by taking our vehicle beyond the territorial limits of the United States, and by launching it into international space, we were technically undertaking an export.

Mr. Volkmer. When did you actually start what I call the process, the actual process of saying this is what we want to do, and want to apply for a temporary export permit?

Mr. Bennett. We applied for our temporary export permit in late July 1982.

Mr. Volkmer. And you are still not completed with the process?

Mr. Bennett. No, sir.

Mr. Volkmer. Were you prepared to complete everything in the process, or is it the Government delay that has taken this time?

Mr. Bennett. I would say in this particular instance, it has been a situation where we had a new and pioneering activity. We at some points were not ready to fully declare some of the parameters that they wished to know. So, we do not fault the agencies for the fact that the permit review is still going on. It was an interactive process, a pioneering effort. We have no fault with the way it has been conducted so far.

Mr. Volkmer. You have made your recommendations in your statement. As a general question: In the event that we do go along with some legislation, the idea of licensing launches, do you believe that each launch should be licensed individually? Or should we license the type of vehicle that is used as a launch vehicle, and say that it has a permit to be used in certain areas for certain types of launches?

Mr. Bennett. I believe that essentially what you are proposing would be a reasonable approach, in which, sir, we take an individual vehicle and when it is first going to be launched, never been launched before, you do an investigation into that vehicle's characteristics. You would, then, issue a statement saying it is authorized to launch under the following conditions and with the following restrictions on its operation, so that you can operate in a safe manner. And then in subsequent launches it would merely be a matter of giving notification to FAA, NORAD, and such, so they can plan around that activity—to the extent there was an upgrade or a change in the vehicle that might be reviewed.

But I think that would be an adequate type of system.

Mr. Volkmer. OK.

You don't see it necessary to license each launch, then.

Mr. Bennett. Only——

Mr. Volkmer. Go through the procedure of licensing.

Mr. Bennett. I think that all that would be necessary would be a very quick review of the fact that the type of vehicle has been inspected before, I believe there will probably be some kind of requirement to inspect the payload for national security purposes. And, as I say, notification of convenience to airmen and such would be the only requirements for individual launch.

Mr. Volkmer. But you should not have to show the same statistical data as far as the launch vehicle is concerned.

Mr. Bennett. As long as it is the same vehicle being launched in the same mode as before, no.

Mr. VOLKMER. You do not at the present time have any agreements with NASA?

Mr. BENNETT. No, sir, we do not.

Mr. VOLKMER. You don't contemplate the need for any, is that correct?

Mr. BENNETT. No; our plans allow us to proceed to the point of launch and having our vehicle in service without either buying or selling anything to the Government.

Mr. VOLKMER. You also emphasize that you see no need for Government funding or Government loans, or Government grants, or anything else, to people involved in commercialization.

Mr. BENNETT. No, sir. Our business plan projects us being able to provide the sort of service with no change in the current tax structure or economic——

Mr. VOLKMER. No tax incentives, no guaranteed loans from the Government.

Mr. BENNETT. We do not require any of that, sir.

Mr. VOLKMER. As I understand it, do you foresee at any time you would be launching from land, continental United States?

Mr. BENNETT. At a time in which a customer has a requirement that could best be served by launching from land, then we would undertake the launch from land.

Mr. VOLKMER. Would you at that time propose to use Government facilities or construct your own facility?

Mr. BENNETT. Based on the situation that we obtained at the time in the sense of the availability of the Government launch sites, the cost, the reliability of the terms, long term, we would certainly investigate the use of Government launch facilities first.

I think constructing an entirely new facility on land would be something that we would only do for any of the reasons I mentioned above—the Government facility did not seem to be the most adequate.

Mr. VOLKMER. Do you see any need for the question of licensing of launches and the launch site?

Mr. BENNETT. I certainly hope that the regulatory structure that emerges will allow for the creation of private land launch sites, because this would remove a potential constraint on the number and type of activities that could be carried out privately in the United States and would reduce the danger of a de facto economic regulation by the agency controlling the launch sites assigning an order or excluding certain launches on different criteria from Government launch sites. That would be Government regulation by the back door.

Mr. VOLKMER. Wouldn't there be a possible need at least to have some Government say-so as to location of those, so that there should be some type of licensing procedure for that?

Mr. BENNETT. Certainly, I think that there should be an established procedure for approving a specific nongovernmental launch site, with a set of safety standards. But those should be also as little as possible.

Mr. VOLKMER. Now, are you going to do your own tracking?

Mr. BENNETT. We eventually will have the capacity to do our own tracking. For the first several development launches, we will rely partly on our own tracking facilities aboard ships, and we are also now discussing with the national ranges at the Western Space and Missile Center at Vandenberg Air Force Base and the Point Mugu Air Station, the possibility of leasing some radar tracking capability for the first development launches.

Mr. VOLKMER. So, there would be some agreement with a governmental agency there.

Mr. BENNETT. If we chose to go that route. Then we will have an agreement with the range that would provide that service.

Mr. VOLKMER. I have no further questions.

I wish to congratulate you and your associates for your entrepreneurial spirit in the face of everything. I think you should be commended for it.

We will be glad to work with you. If you do run into problems as you go through the process of obtaining your license or permit, we would like to know.

Mr. BENNETT. Thank you very much again for this opportunity. I believe we will have further need of discussion of this matter in the future. We will be very happy to provide information whenever the committee requires it.

Mr. VOLKMER. Thank you very much.

The subcommittee will stand adjourned.

[Whereupon, at 4:45 p.m., the subcommittee adjourned, to reconvene subject to the call of the Chair.]

APPENDIX A

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

encouraging business ventures in space technologies

Report by a panel of the
National Academy of
Public Administration

Prepared for the
National Aeronautics and
Space Administration

Encouraging Business Ventures in Space Technologies

Report by a Panel of
The National Academy of Public Administration

Prepared for the National Aeronautics
and Space Administration

May 1983

Table of Contents

Page

Preface
Foreword
Summary i

Introduction 1

I. Maintaining United States Space Leadership 4

- Benefits of the Space Program 4
- Adverse Consequences of Loss of Leadership 5
- Impacts of Foreign Competition 6

II. The Private Entrepreneurial Role 10

- Risk-taking in Space 11
- Phasing NASA Out of Operations 12

III. The Several Roles of NASA in Support of Commercialization 13

- Development of Unique Capabilities 13
- Using Industry Capabilities 15
- Space Applications Research and Development 15
- Protecting Intellectual Property in Space Activities 18
- Strengthening the NASA - Industry Interchange 18
- Modes for Risk Reduction 19
- Scientific and Technical Manpower 20

IV. Organizing for Commercialization 22

V. Launch Services 25

- Expendable Launch Vehicles 25
- Space Shuttle 25
- Competition and Commercialization 26
- Acquisition of Expanded Shuttle Capabilities 27
- Launch Services Stability 27

VI. Financial Considerations Affecting Investment 29

- Realistic Valuation of Government Interest 29
- Insurance 32
- Federal Income Tax Considerations 34

VII. Anticompetitive Considerations 37

VIII. Organizing for the Regulatory Process 40

IX. Addressing National Security Concerns 43

X. Guidelines for NASA Evaluation of Commercialization Proposals 45

General Principles 45
Policy Considerations 46
Specific Requirements 48

Appendix 1 Panel Membership

Appendix 2 National Space Policy, July 4, 1982

Appendix 3 Meteorological and Land Remote Sensing (Landsat) Satellite Systems

Appendix 4 NASA Guidelines Regarding Early Uses of Space for Industrial Purposes
NASA/Industry Working Relationships

Appendix 5 Protecting Intellectual Property in Space Activities

Appendix 6 Excerpts from Treaties Governing Space Activities

PREFACE

This report, prepared by a Panel of the National Academy of Public Administration, presents the findings of a study initiated at the request of the National Aeronautics and Space Administration (NASA). The issues analyzed in this investigation concern the relationships between the public and private sectors in the commercial utilization of the space environment and the requirements of a policy framework conducive to business ventures based on space technologies.

The major audiences being addressed in this report are the business and government leaders who will make the decisions determining the nature and extent of America's future in space. In the business community the major audience consists of executives involved in strategic planning, the search for new business opportunities and the overall direction of research and development programs. The public sector audience includes both those executives in NASA who deal on a day to day basis with industry proposals for commercial initiatives and those in other executive branch agencies and the Congress who are now seeking to resolve some of the complex questions posed by the prospects for business ventures in space technologies.

The issues prompting NASA to request the study arose from the novel circumstances leading to the stated policy of the Federal Government to encourage private investment in space enterprises. However, the specialized concerns addressed here are an important part of a more general dialogue regarding the search for business-government relationships favorable to technological innovation and the renewal of American competitiveness in global markets. A major theme emerging from the Panel's deliberations is the need for business and government teamwork in rebuilding and exploiting the research and development capabilities of the United States.

This report follows ten other studies conducted by the Academy at the request of NASA over the past decade on critical management, administrative and organizational issues confronting the agency. A list of these earlier reports appears on the back cover of this report. Like the present investigation, most of the previous studies were the product of Academy panels supported by professional staff.

Those chosen to serve on the Panel for this study brought to it a unique mix of experience and knowledge gained in distinguished careers in business and government relevant to the Panel's task. The majority of the panelists have occupied senior managerial positions in business representing a range of perspectives and insights on the corporate decision-making process.

The Panel has met on six occasions over a six month period to review the complex array of issues, to analyze the literature on the subject and to obtain the views of key figures in NASA, other federal agencies and the private sector. Extensive interviews conducted by the Panel staff were reported to the Panel as background information on the views of knowledgeable governmental and business executives. A succession of draft reports reviewed by the Panel has culminated in the final product.

As the study was being launched, the Administrator of NASA, James M. Beggs, formed a task force of senior NASA officials having a principal interest in the concerns of the study to interact with the Panel. The interaction with this task force has taken the form of joint meetings with the Panel and individual consultation with task force members concerned with particular aspects of the study. This device for involving NASA officials in the work of the Panel has provided effective support for the Panel's efforts.

The Academy is indebted to all those who contributed to this endeavor. The Panel chairman, Philip Klutznick, generously devoted time and personal commitment throughout the undertaking. Other panel members were Stover L. Babcock, Jr., Richard H. Bolt, Samuel M. Cohn, Emilio Q. Daddario, Harold B. Finger, Peter G. Goldmark, Jr., John A. Johnson, Gerald J. Mossinghoff, Mitchell Rogovin, and Thomas O. Paine. Project teams from seven companies met with the Panel to describe their proposed initiatives and to discuss the opportunities and problems associated with their respective ventures. The support received at all levels of NASA, especially the Office of Technology Utilization and Industry Affairs which served as the agency monitor of the effort, was indispensable to the work of the Panel. Ronald J. Philips, the director of that office, and Stanley R. Goldberg, the NASA project manager, as the principal NASA links to the Panel, provided continuing support to the effort.

Gerald Mossinghoff, the United States Commissioner of Patents and Trademarks, prepared the appendix on intellectual property. Milton Carrow of American University, working in association with the Panel Vice Chairman, Mitchell Rogovin, served as a consultant to the Panel on antitrust issues. Jean Guard Monroe served as technical editor of the report.

****

Finally, I want to acknowledge the dedicated efforts of the Panel staff. Erasmus H. Kloman, Senior Research Associate of the Academy, served as Project Director drawing on his experience in a similar role on numerous other Academy studies. Craig Voorhees, as research associate, brought to the project the in-depth familiarity with the space program gained from extensive service on the Senate authorizing committees. Debra Kearse provided valuable secretarial support and a cheerful attitude throughout the project.

J. Jackson Walter
President

FOREWORD

The United States embarked on its voyage of discovery in space mainly in recognition of early Soviet accomplishments in space and the need to attain a U.S. leadership position in the exploration and use of this new frontier. The American people have already earned enormous benefits from the great achievements of those who have made the space program one of man's great technological triumphs.

Other considerations that prompted the decision to explore this new frontier were the desire to expand scientific knowledge of the universe and the prospect of economic benefits. The value of the scientific knowledge acquired to date is beyond quantification. Furthermore, if we look only at the economic impacts of the space program, which are the focus of this study, we observe that many important economic gains have already been scored, two notable examples of which are the creation of the communications satellite industry and the many advances in space-related computer technology which have been applied to civilian uses.

The importance of maintaining a United States leadership position in space is so great that the nation must continue its activities on this frontier without counting on further substantial economic side effects or benefits. At the same time, it is increasingly evident that the role played by the private sector up to now in strong support of the government's program has opened up promising vistas of opportunity for the private entreprenuer. While these opportunities may be seen as a by-product, it is clear that, by assuming a larger role through commercial ventures in space, private entrepreneurs can provide an enormous assist to the maintenance of United States leadership in space.

At a time when our nation has suffered losses in areas of technological creativity where it was once the undisputed leader, the space program has provided a compensating stimulant, the tempo of which must not be lost. The prospect for business ventures in space technologies represents a major opportunity to demonstrate that within the free enterprise philosophy there is a great potential for cooperative endeavor between the public and the private sector. Pursuit of this opportunity could become a model for joint public/private efforts in other areas.

Philip Klutznick
Chairman
Panel on Encouraging Business
Ventures in Space Technologies

SUMMARY

Within the past quarter century the United States has penetrated the frontier of space exploring even distant reaches of the solar system. The space program, born of national resolve and financed by the American people, has opened the space environment to the scrutiny of mankind.

Spurred by fears of vulnerability to the Soviet presence in space, the United States inaugurated a space program that has yielded substantial benefits to the nation. A major goal of our national space policy today is to maintain the position of U.S. leadership in space. Now, moreover, we begin to see emerging possibilities for private industry to use space technology and the space environment for new commercial ventures. The resulting business could serve to strengthen the economy, expand employment and improve the nation's posture in the global competition for high-technology markets.

The extent to which past investment in space technology contributes to our future economic well-being and national growth will depend in large measure on policies and actions taken in a spirit of collaboration by the Federal Government and industry. Unless the public and private sector join to develop the opportunities presented by new space technologies and unless entrepreneurial forces are engaged more fully, the United States will fall behind in the contest for leadership in space and the economic rewards associated with that position.

The Panel recommends the following policies and initiatives for adoption by NASA to encourage business ventures in space technologies:

1. Declare and institutionalize a major commitment to the commercialization of space technology.

- Make a clear statement of commitment to commercialization as a policy of NASA, and announce the policy widely within NASA and throughout the government and the public.
- Establish within NASA a well defined, top-level management focus for the commercialization of space technology.
- Present the case for commercialization within the government, and offer advice and assistance to entrepreneurs seeking guidance in complying with applicable governmental requirements.

2. Assist industry in pursuing opportunities for profitable investment in space.

   - Develop mechanisms, including collaboration with the Department of Commerce, to establish relations with all segments of American industry that could play an effective role in commercializing space technology.
   - Encourage the private sector, including small and new companies, to seek opportunities in applying space technology, as a promising investment of their effort and risk capital.
   - Identify new requirements for services and products that need not be developed as a traditional NASA controlled and funded development, and publicize the requirements as offering opportunities for private endeavor.
   - Adapt experience gained in the government/industry advisory and experimental relationships in NASA's aeronautical research programs to the commercialization of space technology.

- Use and expand NASA's Technical Exchange Agreement and Industrial Guest Investigator program to promote exchange of information between industry and NASA.
- Make the fullest possible use of the Joint Endeavor Agreement and other innovative mechanisms to help increase the usefulness and decrease the costs and risks of space transportation and other NASA facilities.

3. Offer NASA facilities and services for use by private companies under conditions that encourage commercial development.
   - Consider facilities such as the space shuttle and any future space station to be national resources available for use in commercial efforts, under explicit conditions, toward national economic benefit.
   - Make launch services as predictable and reliable as possible, in order to permit sound business planning and investment.
   - Respond promptly and affirmatively to proposals for commercial operation of expendable launch vehicle systems (ELVs) under guarantee by the commercial operator to fulfill all existing United States Government commitments for launch services by those ELVs.
4. Continue R&D including study of long-range opportunities.
   - Undertake R&D to provide unique research and operating capabilities too costly or technologically complex and advanced for private investment.
   - Pursue NASA R&D in satellite communications and other space applications technologies relevant to United States leadership.
   - Increase the emphasis on all aspects of the NASA program of materials processing in gravity-free conditions.

- Recognize that full commercial exploitation of space will need to involve private transportation facilities, and consider long-run potentials in judging proposals for private financing and marketing of space vehicles, even if the proposed plan is not feasible now.

5. Reduce the risks and restrictions that impede commercial exploitation of space technologies.

- Continue flexibly using authority to accord full rights in inventions and proprietary information to private parties in joint endeavors.
- Continue to keep informed on needs for insurance to protect against risks and work closely with the insurance industry, but do not put NASA in the insurance business.
- Encourage simplification of federal regulations for space launch systems and associated payload activities, and provide technical advice but avoid placing NASA in the role of regulating commercial activity.
- Advocate commercialization within the Senior Interagency Group on Space and the promulgation through the SIG of criteria for determining the national security acceptability of proposed ventures.

In requesting this study NASA identified a need for a clear set of guidelines for evaluation of commercialization proposals submitted to NASA. The final section of this report suggests general principles to govern this process along with policy considerations and specific requirements to serve as a basis for determining the NASA response to private initiatives.

Encouraging Business Ventures
in Space Technologies

Introduction

During the late 1960s and 1970s large sectors of the American economy did not perform well. The requirements of modern technology and contemporary markets marked a shift from a world where historical American dominance in high-volume, standardized mass production guaranteed a strong and competitive American economy.

The implications for the United States of the emerging world economy appear to include the need for:

-- rapidly evolving and diversified technologies;

-- flexible teams organized to design and manage complex systems rather than to define and manufacture fixed products;

-- goods and services that can command overseas markets.

In all these respects the aeronautical and space industries have been excellent performers during an uneven period in American economic history. The programs of the National Aeronautics and Space Administration (NASA) and related Department of Defense (DOD) undertakings have fertilized and seeded a broad spectrum of companies, helping to keep American industry competitive. These activities encourage and demand the kind of task-oriented, flexible teamwork and management necessary for high productivity and effective performance in the world economy.

As NASA turns to commercialization of space, therefore, it is necessary for NASA and the entire government to take full cognizance of the constructive and catalytic role space efforts can play in sustaining the technological and economic competitiveness of large sectors of American industry. In explicit recognition of that responsibility it is also necessary to define national policies so that this catalytic role can be sustained and expanded.

Thus the central focus of this inquiry is how to engage the creative skills and entrepreneurial initiative of the private sector in the exploitation of space technologies. Many issues have been explored by the Panel in its search for answers to this central question. The Panel has examined the overall relationship between government and business, the process whereby decisions on investment of risk capital are made, the existing structure and mechanisms through which NASA seeks to encourage private initiatives, the growing number of private space technology ventures in various stages of development, and the increasing activity evident in Japan and Western Europe where national governments are targeting specific space technologies for development.

From the outset of this endeavor it has been apparent to the Panel that the national interest is closely related to maintaining the position of U.S. leadership in space. As the study has progressed, the Panel's awareness of the significance of this leadership position has intensified. At the same time, the Panel has become increasingly conscious that maintaining this position depends on engaging the private sector, while continuing strong support for the government's space program.

In discussing the prospect for commercialization of space it is essential to distinguish between the various classes of commercial applications. There are several ways in which such applications could be categorized. Some applications relate to launch systems or services, such as proposals to commercialize expendable launch vehicle (ELV) systems or shuttle-based projects. The special characteristics of these space transportation enterprises are discussed in Section V.

Other commercial applications, not associated with launch systems, cover a wide range of products and services. Some of these offer support to spacecraft while others are intended to meet consumer needs. In the first category are projects such as spacecraft processing (or the integration of payloads and spacecraft), leasing on-orbit spacecraft facilities, repair/maintenance of satellites, satellite tracking and command/control services. The second category, consumer-oriented applications, includes communications satellites, remote sensing, materials processing and various promotional enterprises. A complete catalogue of commercial enterprises would include a category covering a variety of goods and services from space-based technologies yet to be conceived.

The distinctive attributes of these three classes suggest that generalizations about space commercialization can be misleading. The opportunities for investment in these different types of enterprise will interest different entrepreneurs and investors. The size and conditions of the investment involved will vary greatly from one area to another. Nevertheless, there are important factors in common among the three market areas. While the discussion which follows takes account of these differences, it concentrates on the points in common and the need for creating a climate conducive to investment.

I. Maintaining United States Space Leadership

The National Space Policy of July 4, 1982, sets out as one of its basic goals "to maintain United States space leadership." (See Appendix 2) Entering the space age, the United States and the Soviet Union were the only two contenders for that leadership, and both maintain strong space programs today. Morever, other industrial nations in the non-communist world have stepped up their own space programs. Among the industrial democracies, the United States still holds a commanding lead in its overall space capabilities as exemplified by the great transportation flexibility afforded by the shuttle.

Benefits of the Space Program

The impetus for United States activity in space has been essentially threefold - - to safeguard national security, to increase scientific knowledge of the universe, and to accrue economic benefits. All three are closely interrelated. However, since the Panel's mandate is focused primarily on the third goal, this report deals mainly with economic concerns. The civilian space program of the United States represents an expenditure of about $100 billion. Past support for this public investment has assumed that it would yield a significant return to the economy along with major advances in scientific knowledge and technical information of value to the military space program. Indeed, very high economic returns have already been realized through the beneficial effect of the civilian space program on innovation and product development in a number of high technology industries such as data processing and telecommunications.

A principal benefit to be gained from continuing strong support for the United States civilian space program is the further strengthening of the competitiveness of our economy. Increasing levels of activity by private investors in space technology ventures suggest that the nation may be on the verge of realizing further economic benefits. Estimates of the value of goods and services to be produced from space are at this point necessarily conjectural. Besides the thriving communications satellite industry, most other privately financed space technologies are still in a developmental stage. However, the Panel believes that there is a very real opportunity for increased commercial enterprise based on space technologies. New products or services, productivity improvements and other national benefits from scientific advances can be achieved. The realization of that potential will depend in great measure on joint efforts by the Federal Government and the business and financial communities to carry out the commitment in the National Space Policy "to expand United States private sector investment."

Adverse Consequences of Loss of Leadership

Another way of looking at U.S. space leadership is to ask what adverse consequences would ensue from a substantial erosion of that leadership. In the first place, it is apparent that U.S. national security and geopolitical interests would be jeopardized by allowing the Soviet Union to surpass the United States in key space applications. Recent substantial increases in the U.S. military space budget are a recognition of the importance of national security considerations.

Any significant reduction of U.S. efforts will also have adverse effects on space sciences research. NASA's scientific programs represent a precious national asset. They contribute to man's ability to understand his environment and the Earth's place in the universe. They are essential to promote the intellectual vitality of American science. They provide a knowledge base from which to advance both civilian and military space technologies.

The adverse consequences of failure to maintain the U.S. position in space would be felt acutely on the economic front. U.S. aerospace exports in 1982, for example, amounted to $15.6 billion. The Western European nations, especially France and Germany, and to an even greater degree, Japan have entered into keen competition with the United States in a number of high technology areas that they have targeted as commercial priorities. Given U.S. policies of sharing information derived from our space program "for the benefit of all mankind" it is reasonable to expect that other nations would develop their own capabilities in competition with our own.

Impacts of Foreign Competition

One of the major goals of the National Space Policy is to "promote international cooperative activities in the national interest." Certainly international cooperation has helped to advance U.S. programs as illustrated by the $900 million financing by the European Space Agency of Spacelab as an integral component of the U.S. space shuttle system. Nevertheless, it must be recognized that the U.S. economy is suffering severely from the erosion of its once dominant position in high technology areas as a result of the impressive gains by Japan and Europe in such fields as electronics and communications. While the individual space budgets of these foreign competitors remain below U.S. levels, they have significantly increased their public expenditures for space programs in recognition of the benefits of such endeavors to the strengthening of their national economies. Their space programs are viewed as an impetus in their overall efforts to compete in high technology areas.

Western Europe and Japan's tradition of government-business partnership is a major factor in the increasing competition with the United States. The European nations have a long history of sponsoring cartels to gain the greatest possible share of world markets. In Japan, the Ministry of International Trade and Industry (MITI) is a dominant feature of that nation's successful efforts to promote a strong economy through job creation and exports. MITI, as an arm of government, exercises great influence in determining where Japan will focus its efforts and which industrial firms will be the chosen instruments for collaboration in developing new markets at home and abroad. MITI concentrates its resources in the strategic areas of microelectronics, including robotics; biotechnology; new materials, such as ceramics and carbon fibers; and optical fibers for communications equipment. The Japanese space agency, NASDA, spearheads national efforts in targeteted areas of space techology.

In the United States there is also a record of government working with and subsidizing the private sector in selected areas. Federal land grants to the railroads in the 19th century and support to the airline industry in its formative years are notable examples of this tradition. More recent examples are found in the stimulating effects on the computer industry of procurements by the DOD and NASA and the partnership between the aviation industry and the National Advisory Committee for Aeronautics (NACA) and its successor agency, NASA.

Over the 25 years of its existence approximately 90% of NASA's annual research and development (R&D) appropriations have been spent in contracts with industry and various forms of financial support of academic research institutions. During the first half of this period NASA funding was a major factor in developing the capability of American educational institutions to train technicians and engineers for the rapidly evolving technologies of space.

Nevertheless, any comparison of NASA or other parts of the Federal establishment with European or Japanese approaches to competition for global markets reveals that similarities are greatly outweighed by significant differences. The U.S. commitment to the competitive enterprise system is inconsistent with a centralized planning system or industrial policy through which the government sets production priorities, targets industrial sectors for special emphasis and subsidizes the private participants in selected enterprises. The American economic system is based on belief in the principles of private enterprise and the force of competition as the most effective means of promoting economic well-being. There is, however, growing recognition that teamwork and cooperation often produce more positive results than the sometimes adversarial relationship characterizing labor-business-government relations in the United States.

Some statistics comparing United States and Japanese performance during the past two decades illustrate trends which are changing their relative positions. In 1962 the United States' share of industrialized country high technology exports was 30.3 percent; by 1980 it was 23.9 percent. Japan's share grew from 4.1 to 12.3 percent. Japanese R&D expenditures as a percentage of gross domestic product rose from 1.5 to 2.0 percent between 1964 and 1979, while it fell from 3.1 to 2.4 percent in the United States. In absolute terms, of course, the size of United States R&D expenditures is far greater than those of Japan.

In some respects, however, the Japanese have more flexibility in discretionary research than the United States. The U.S. military umbrella that has relieved Japan of so great a share of its responsibility for funding its own national security program has allowed Japan to select targets of opportunity for R&D activity. As defense and other requirements associated with the world leadership position of the United States have increased, the discretionary share of R&D funds has diminished. Furthermore, the United States as a world leader must finance R&D across the entire science and engineering spectrum to avoid missing any areas of opportunity; Japan and other nations can examine the results of these initiatives and concentrate their own efforts on those areas offering the greatest industrial potential. The concept of teamwork or partnership, as exemplified in the early NASA experience, deserves increasing emphasis in American efforts to protect the nation's position in the increasingly intensive competition for high technology markets.

II. The Private Entrepreneurial Role

The United States relies on private enterprise as the driving force of its economy. Government is not viewed under most circumstances to have a role as a producer or marketer of goods or services. Recent years have brought renewed recognition of the importance of the entrepreneur as the generator of innovation, greater productivity and growth. Interestingly enough, this recognition transcends party lines and is reflected, albeit with varied responses, on both sides of the political aisle. The high technology enterprises of the future will call for a wide range of entrepreneurs. In some instances they will be large established companies; in other cases individuals or small groups will try to enter into new high technology ventures. All types are needed to develop the commercial potential of space.

Small entrepreneurial ventures in high technology markets such as electronics and communications are demonstrating increasing ability to develop innovative ideas into profitable enterprises. These firms enjoy greater flexibility than most larger established corporations. They are responsible for an important share of new jobs especially in high technology industries. In comparison with larger companies, however, the small firms are more burdened by the administrative, legal, financial and regulatory complexities involved in dealing with the Federal Government. Small firms often lack the experience and resources needed to make their way around in Washington and in the NASA bureaucracy.

The advantages enjoyed by larger firms in dealing with NASA and other parts of the executive establishment point to the need for an evenhanded policy in considering private sector commercialization initiatives assuring that there is no discrimination against smaller firms.

Risk-taking in Space

The hallmark of private enterprise is the placing of capital at risk. With some notable exceptions most of the great achievements of the American economy have resulted from the willingness of private investors to invest in creative ideas. The process for deciding what ideas will succeed in the marketplace has become increasingly sophisticated as technological, financial and marketing factors have become more complex.

Capital risk-taking in space would seem at first glance to be even riskier than ground-based ventures. Indeed it seems to require either a past familiarity with space technologies or a special pioneering spirit to engage entrepreneurs in this arena. Even so the Panel has observed that a significant number of private companies are either already embarked or preparing to embark on one of the several types of commercial applications described above.

As with more conventional ground-based enterprises, the success of these new space-based ventures will depend on the rigor of the process leading to a go/no go decision on investment. Just as that process has been a critical factor in shaping and building the great domestic economy of the United States, so is it essential to America's future in space. Hitherto, the Federal Government has played the lead role in funding and directing both civilian and military space programs. Although NASA's budget in the past two years has increased slightly, it seems unlikely that the high budget levels of the 1960s will be resumed. In order to retain the momentum of the past and to maintain the economic competitiveness of the United States in space technologies, the private sector will have to become increasingly involved both as provider of risk capital and as innovator of enterprises with the potential for profit.

Phasing NASA Out of Operations

The great contribution of NASA to American society and the world at large has been made by continuously advancing the state of the art of space technologies. Through its unique approach towards advanced research and technology, NASA has performed the most challenging missions to place the United States in a leadership position in space. NASA management both in Headquarters and the field has generally been extremely selective about the assignments they would undertake. Once knowledge has been gained about how to produce a piece of hardware and make it function, the value of the learning experience from repeating the task diminishes.

Thus NASA has refrained wherever possible from engaging in repetitive operations, preferring to concentrate on new R&D initiatives. When it has proven feasible, as in the case of communications satellites, NASA encouraged the private sector to take over, thus reserving its talents for other priorities. At the present time, NASA is phasing out of the operation of two major expendable launch vehicle systems which may be commercialized, and is looking ahead to the time when commercial operation of the shuttle may become feasible. Other opportunities for commercialization of products and services in support of spacecraft and for public consumption are also under active consideration.

In any institution undergoing change there is a tendency to perceive the phasing out of functions as a diminution of the institution's responsibilities. In fact, however, the commercialization of enterprises in space will add to, rather than detract from, the need for NASA's research and technology function. As the number of commercial enterprises in space increases, there is likely to be a corresponding increase in the requirements for the kinds of basic and applied research for which NASA is uniquely qualified.

III. The Several Roles of NASA in Support of Commercialization

NASA has been and continues to be a mission-oriented organization, a factor that contributes significantly to its successes. This concentration on specific objectives focuses efforts, identifies research and development needs, and presents challenges for accomplishment. The benefits of this approach while apparent in highly visible achievements are also to be found in the broad research and technology base that has been established. NASA should strive to maintain this approach. In addition to the technology gains, such an approach is essential to attracting, stimulating and retaining the high caliber scientific, engineering and management personnel required to undertake the high technology endeavors inherent in space exploration and exploitation. Further, a strong advanced R&D activity is the best counter to any perceived threats to the institution or its people that may emanate from a concurrent commercialization thrust by the agency.

Development of Unique Capabilities

There is a distinct role for NASA in the space commercialization process. First and foremost, NASA has developed the basic space flight transportation capability in the form of the expendable launch vehicles and the space shuttle, a capability most unlikely to have ever been initiated by the private sector. It has demonstrated that man can live and perform useful work in the space environment. It has developed and demonstrated the technologies for communications, meteorological and land remote sensing satellites. Finally, it has conducted experiments in materials processing and other research in many high technology areas.

The space shuttle has demonstrated its commercial satellite launch capability from low earth orbit. However, its many other capabilities which are essential to commercial initiatives remain untested. Manned extravehicular activity (EVA) must become routine. Accomplishing the EVA objective, and learning to use and expand the shuttle's capabilities are functions only NASA is equipped to perform. Devices for supporting experiments and subsequent operations in materials processing, for example, are yet to be developed; there is also a need for additional lower cost electrical power on orbit. Space station studies are presently underway in NASA. In the longer term, it can reasonably be expected that more efficient transportation systems will become technically feasible.

The space shuttle, its derivatives, and a space station are not only multi-user facilities but also are very large, high-risk investments beyond the financial capability of individual companies. **Such facilities should be viewed as a national resource which, although developed by the government, provide research and operational capabilities the results from which can be exploited within clearly developed principles by private sector organizations for their own interests and for national economic benefit. The use of these facilities by the private sector should be encouraged by NASA.** The precedent for NASA development of major national facilities exists in the various aeronautical research wind tunnels constructed and operated by NASA and its predecessor NACA. In addition there is the example of the NASA expendable launch vehicle capability which, in recent years, has been chiefly devoted to the launch of commercial communications satellites. These national facilities have contributed directly to U.S. success in the fields of aviation and communications. **The Panel believes the policy with respect to such major facilities should remain unchanged; i.e., NASA should provide basic or unique research and operating capabilities too large or advanced for initial private sector investment.**

Using Industry Capabilities

The NASA policy of acquiring and operating its facilities, equipment, and technical services through industrial contractors has built a competence for supporting new initiatives and exploiting space technology in the private sector. For example, several proposals to NASA involve private financing of some of the shuttle infrastructure. These are opportunities to facilitate the commercialization process and reduce NASA funding requirements without posing a threat to NASA's principal mission - - research and development. **Therefore, after identifying a specific requirement for a product or service and determining that there is no compelling need to meet the requirement through a traditional NASA-controlled development program, NASA should advertise the need within the private sector as a commercial opportunity concurrently announcing that it will not initiate a competitive development.** However, difficulties encountered in the tracking and data relay satellite program in accommodating a governmental and commercial function in a single spacecraft underscore the importance of a thorough examination of the government's interest before making a private sector commitment.

Space Applications Research and Development

The NASA space applications programs are directed to the productive use of space technology and the space environment. They include but are not limited to technologies for communications, atmospheric and land remote sensing, ocean monitoring, navigation and materials processing. Research and development in the space applications field has been a major role of NASA since its inception. For example, the first transmission of global cloud cover pictures from a meteorological satellite was made from Tiros I launched on April 1, 1960. This success was followed by the Syncom II synchronous satellite communications technology demonstration in 1963. Concurrent with its continuing R&D activities to develop improved satellites and instrumentation, NASA pursued new R&D directions such as the development of the multispectral scanner to remotely monitor earth resources with the Landsat system. Demonstration of this technology was followed by R&D efforts to enhance its capability resulting in the development of the thematic mapper. The operational meteorological and land remote sensing systems are the responsibility of the National Oceanic and Atmospheric Administration (NOAA). (See Appendix 3.) Except for DOD-owned systems, satellite communications operations are commercialized.

Events over the past twenty years have established a two-fold R&D role for NASA in space applications - - namely, to explore new opportunities for the application of space technology and to improve demonstrated technolgies to achieve the extensive operational capabilities available today. The Panel believes these activities support critical national needs; therefore, this NASA role should be continued and expanded. An element of this role is perhaps best illustrated by the need for advanced communications technology including work in the 30-20 GHz frequency range. Since its demonstration in the early 1960's, the private sector has translated synchronous communications satellite technology into a highly successful growth industry. The communications satellite industry is the principal current example of commercialization of space technology, yet new technological breakthroughs are now required to maintain U.S. leadership and to realize continued economic benefits. The estimated cost of this advanced technology development exceeds the financial capability of any single firm in the industry. The Panel recommends that NASA pursue this R&D requirement and any

similar cases in space applications through demonstration of the applicable technology. In so doing, NASA should explore the feasibility of adapting the mutually beneficial experience accruing from the government/industry working relationships in conducting its aeronautical research programs, wherein NASA conducts R&D and in certain cases industry performs hardware fabrication and flight testing of new technologies under cost-sharing arrangements.

The space shuttle manifest reveals that with minor exceptions presently scheduled commercial payloads consist of communications satellites. This fact pointedly suggests the need for NASA to identify and develop new initiatives in the application of space technology if there is to be extensive commercial utilization of the space environment. Initial research in materials processing has led to a major commercial experiment in electrophoresis under a NASA Joint Endeavor Agreement (JEA) through which NASA provides space transportation; an aerospace firm, McDonnell Douglas, provides experimental hardware and the NASA interface; and a health products company, Johnson and Johnson, furnishes experimental materials and a processing and marketing organization for products developed. It is an endeavor that fits well into the existing technological, industrial, business and marketing strengths of the participants. The Panel endorses this innovative JEA activity by NASA which was originated under guidelines issued by the Administrator on June 25, 1979 for the early usage of space for industrial purposes. (See Appendix 4.) Nevertheless, the fact that this experiment stands alone supports the frequently expressed view that a science base has not been established for materials processing in space. **The Panel recommends more emphasis on all aspects of NASA's materials processing program inasmuch as this appears to hold large potential for commercialization.**

Protecting Intellectual Property in Space Activities

In recognition of the substantial investment necessary to develop the electrophoresis experiment in the joint endeavor, NASA negotiated special clauses dealing with inventions and technical data. Those clauses provided that as long as the party engaged in the joint endeavor with NASA continued to pursue the experiment, that party would retain all rights to inventions and proprietary technical data. NASA would not take a government license or any "march-in" rights to require licensing of others. The only exception is if the NASA Administrator, in response to a national emergency, determines that an invention made in the performance of the joint endeavor is urgently needed for public health reasons. The Panel recommends that NASA continue to use its flexibility to accord full rights to inventions and proprietary technical information to private parties willing to invest substantial sums in joint endeavor agreements. (See Appendix 5.)

Strengthening the NASA - Industry Interchange

The continuing NASA programs in space research and technology and in space applications should provide a climate for the pursuit of the most imaginative ideas. However, as new developments are conceived, there is an urgent need to create an awareness of research findings among the commercial/industrial sector so as to (1) seek earlier involvement of the private sector in assessing commercial potentials and (2) plan for successful commercial exploitation of the concept early in the research and development phase. A mechanism is also necessary to apprise the NASA research teams of the trends and requirements of the commercial entrepreneur in the space technology marketplace to identify potentially profitable areas for advanced research. The

NASA Technical Exchange Agreement with industrial firms and the Industrial Guest Investigator program are positive steps toward these objectives and their use should be expanded. (See Appendix 4.) **The Panel also recommends that NASA, while continuing to maintain its traditional links with the aerospace industry, reinforce its efforts to establish new ties with all segments of American industry that can play an effective role in the commercialization of space.**

Modes for Risk Reduction

The July 4, 1982, space policy statement encourages domestic commercial exploitation of space capabilities. The NASA ongoing research and technology development activities represent encouragement in the form of a commitment to explore new concepts continually and to advance technology. These activities serve to reduce the business risk of high technology enterprises to a manageable level particularly when new ideas are carried through proof-of-concept and when joint experiments are conducted as a part of the NASA applications programs.

Further encouragement for the private sector is necessary, however, because of the high cost of space endeavors, particularly the cost of space transportation. Low cost access to space is essential to private sector utilization of the space environment inasmuch as an earth-based endeavor would not be burdened with such a high transportation cost element. This cost factor has been recognized by NASA in the development of its Joint Endeavor Agreement which allows free use of shuttle capability on a non-interference basis. **The JEA, or similar arrangements based on its general principles, should be extended to other proposals including the testing of experimental hardware, and other opportunities to reduce the transportation cost factor should be explored.**

While NASA may reduce technical and financial risk to the entrepreneur through R&D and space transportation, it is also important to assure stability in its commitments over the longer term if investment is to be encouraged. The development of NASA commercialization policies and working agreements with the private sector should recognize the need to provide stability in NASA's business commitments over the extended periods of time usually involved in the development of space technologies.

Scientific and Technical Manpower

The successful conduct of the high technology activities inherent in the space program is wholly dependent on the availability of scientific and engineering personnel. This dependency, with respect to NASA personnel, was recognized in 1958 in drafting provisions for the Space Act. NASA, in turn, initiated programs to support university graduate level students to provide the technical skills to develop the R&D base to carry out major technological initiatives including the Apollo and other space projects. These academic programs were complemented by research grants to, and by contracts with, academic institutions which, while providing new knowledge, also contributed significantly to training additional personnel for the national scientific manpower pool.

In recent years there has been a growing awareness of (1) a shortage of students and faculty in the science, mathematics and engineering disciplines, (2) the broad technological advance in commerce and industry, and (3) the importance of a continuing source of highly trained scientists and engineers to support national economic growth. Commercialization of space technology is no exception; its success will rely to no small degree on the availability of technical skills to identify and pursue private sector initiatives. Commericalization will compete for trained manpower in a nation that is becoming more dependent on that resource for all its industrial and service activities.

NASA currently sponsors programs ranging from the post doctoral level tenable at NASA centers to the precollege-level student program for developing experiments to be carried on the shuttle. In addition, it continues its program of research grants and contracts with the university community. These activities are budgeted in excess of $225 million per year. The Panel endorses NASA activities to encourage student participation in technical endeavors and to support the education and training of additional personnel. Recognizing the current shortage and the importance of technically trained personnel to commercial efforts, the Panel urges NASA to examine its university programs and to take every opportunity to strengthen its ties with the academic community with the objective of increasing the overall availability of highly skilled scientific and technical manpower for aeronautical and space technology initiatives.

IV. Organizing for Commercialization

NASA has many highly visible achievements, reflective of its responsibilities under the Space Act. Within the general business community these accomplishments project a view of NASA as a research and development, high technology, complex engineering, mission oriented organization motivated by technical objectives and limited in the projects and goals it pursues only by government political and budgetary processes. The NASA approach to its work relies heavily on backup systems, exhaustive component qualification, repeated testing, vigorous assessment of technical risk, and extensive documentation, usually for a single item development. Within the program offices, market considerations and financial risk are not perceived as issues. Procurement generally involves sophisticated hardware and technical services and therefore, private sector interactions are predominately with the aerospace industry and its supporting infrastructure of smaller high technology companies. Aside from commercial communications satellites, the aerospace industry principally responds to a government market for space technology and hardware. On the other hand, the non-aerospace commercial/industrial community engaged in producing and marketing a variety of products has little or no familiarity with space technology and facilities and does not have the necessary special technical capability characteristic of space activities.

Against this background, it is clear that, while continuing its statutory research and development functions, NASA faces a new, distinct and challenging role in encouraging domestic commercial exploitation of space capabilities and technology. Success in this role will depend to a large degree on real and perceived agency commitment to the objective, visibility given to it, and organization for it. The NASA program office structure does not lend itself to this goal; program offices, quite properly, are concentrating on scientific and technical objectives. The Panel believes that a clear statement of senior management commitment and a positive program in support of commercialization as a policy compatible with the long-run future of the agency should be widely disseminated both within NASA and externally. Such action would effectively implement the President's National Space Policy. A well defined focus of responsibility at a high level within NASA should be established. Such management action will emphasize the agency's commitment to commercialization internally and externally, and it will also provide the basis for organizing and conducting the many activities involved in the process. Furthermore, leadership of the commercialization effort should be conversant with business decision-making and marketplace experience.

To carry out this role NASA will need to examine organizational elements with a view toward consolidation of present commercialization activities to eliminate fragmentation, increase efficiency, and in the final analysis, to give credibility and support to the agency's commercialization commitment. The work to be accomplished includes:

- the development and implementation of NASA operating policies for all commercialization activities;
- the receipt, review, evaluation of and response to all private sector proposals;
- the development and negotiation of innovative agreements adaptable to varying endeavors;
- the identification of barriers to private sector involvement and the development of solutions thereto;

- the establishment of interfaces with on-going research and development activities in program offices and field centers;
- the establishment of mechanisms to expose private sector personnel to NASA research and development projects in order to identify commercial potentials and to plan for future private sector participation or exploitation as well as to obtain private sector views and trends that have implications for national economic benefit.
- maintaining liaison with other agencies, such as the Department of Commerce, engaged in fostering the growth of high technology industry to identify new commercialization techniques and to participate in joint endeavors on programs offering national economic benefit.

The Panel notes the continuing use of industry advisory committees in the conduct of the NASA aeronautics program to identify areas for research and technology advancement that offer productive benefits to the aviation industry. The Panel therefore suggests consideration be given to some adaptation of this system in the space applications and advanced technology programs, and to strengthening the commercial orientation of the existing Space Applications Board.

V. Launch Services

Expendable Launch Vehicles

NASA currently operates unmanned expendable launch vehicles and the reusable, manned space shuttle providing services to a broad spectrum of governmental and commercial customers, both domestic and foreign. The principal vehicles in the NASA ELV family, the Delta and the Atlas Centaur, have their origins in early United States rocket technology, and have been improved and uprated to a point where they reflect an outstanding reliability record. The Delta has achieved a 97% success record since 1974 with 64 successful launches out of 66 attempts. It currently has a record of 32 consecutive successful launches. The Atlas Centaur has a success record of 40 consecutive launches at this time. With the exception of the two satellites delivered with the space shuttle on November 11, 1982, the Delta and Atlas Centaur have launched all the free world commercial traffic to date.

Space Shuttle

The space shuttle has completed its fourth test flight and its second operational flight. It provides capabilities to use and explore the space environment that are not available with an ELV system. For example, in addition to carrying a larger payload to low earth orbit, the shuttle offers unique features including, but not limited to: manned and unmanned on-orbit experiment opportunities, payload deployment, servicing and retrieval, and satellite repair capabilities. Its versatility and reusability make the shuttle the preferred national launch system for the future with the ELVs to be phased out to eliminate the cost of maintaining two types of systems. The shuttle system has not yet demonstrated its full capabilities and its projected cost effectiveness. However, it does not have the benefit of the fifteen years or so of operational experience enjoyed by the ELV systems, nor does it have in service the full complement of vehicles scheduled for the shuttle fleet.

Competition and Commercialization

United States government requirements excepted, market forecasts of increasing demand for commercial launch services, combined with the current limited operational status of the shuttle system, have encouraged an aggressive marketing campaign by the French Ariane ELV system. They have also resulted in proposals to NASA by commercial ventures to take over and operate the Delta and Atlas Centaur ELVs. A similar proposal has been made to the DOD for the Titan ELV system. While commercialization of the ELV systems would present competition for the space shuttle, so does the Ariane. Therefore, a commercial United States ELV can be viewed as a competitor to the Ariane, providing economic benefits and services that might otherwise be realized abroad. A competitive, rather than a protected, environment should be expected to create added incentive to drive down the cost of shuttle operations. Commercial United States ELVs would also provide a backup to the total U.S. launch capability during the initial shuttle operational period. Ultimately, however, ELV systems cannot provide the broad range of capabilities offered by the shuttle, a factor that mitigates the competitive ELV threat in the long run.

The Panel concludes that NASA should respond promptly and affirmatively to ELV commercialization proposals recognizing that the agency has already made the determination to discontinue production of the Delta and Atlas Centaur systems and that the national space policy endorses the involvement of the private sector in space commercialization. The fulfillment of any existing United States government launch commitment should be guaranteed in the commercialization arrangement.

Since the shuttle system is not yet technicially mature, the Panel does not recommend consideration be given at this time to commercial operation of the shuttle fleet. However, this option should be considered periodically as experience is gained in operating this complex system.

Acquisition of Expanded Shuttle Capabilities

The Panel is aware of the long standing conviction of NASA officials that a fifth orbiter is essential for full and effective use of the shuttle system to meet national needs. There is also a present requirement for a larger capacity shuttle-based upper stage to launch the heavier spacecraft emerging from advanced commercial spacecraft programs. Such a stage is essential for future shuttle effectiveness and competitiveness. Proposals for private sector financing and marketing of both of these vehicles have been presented to NASA. The Panel makes no judgment on the feasibility or worthiness of these proposals; however, both proposals represent possible steps in the development of a commercial infrastructure for space operations. **Since NASA should concentrate on research and development and is limited to activities benefical to the general public, full commercial utilization of the space environment implies the need for a privately owned transportation system. Therefore, NASA should assess these proposals with longer range contributions in mind.**

Launch Services Stability

Space activities are characterized by large investments, high technical and financial risk and by long development periods. These factors place a premium on sound business planning that becomes difficult without the knowledge and stability of launch costs, certainty of launch availability and consistency of government policy over a period of time. **The Panel appreciates that some policies may be beyond NASA's control. However, the agency commercialization policy should recognize the importance to business endeavors of stable launch costs and the availability of space transportation and should strive to minimize any uncertainties.**

VI. Financial Considerations Affecting Investment

Preceding sections of this report have discussed various ways by which NASA can help to encourage business ventures in space technologies by developing a climate attractive to potential investors. This section takes up three sets of related issues influencing investment in such ventures.

The government has been the developer of space technology and the provider of facilities for space activities. These may be essential to commercial enterprises in space. The Panel believes commercialization will be encouraged if existing government assets which are no longer necessary for government programs can be made available by transfer, sale or lease to an interested private entrepreneur. The first item below discusses realistic valuation of these government interests.

The new types of risk involved in commercial ventures in space call for insurance coverages adapted to those risks. The second item assesses the adequacy of the several types of insurance coverage.

The third part of this section presents a short discussion of Federal tax law provisions favoring various types of corporate activities including business ventures in space technologies.

Realistic Valuation of Government Interest

Over the past 25 years, the $100 billion expended in the civilian space program has moved the nation from zero base to a leadership position in space technology. This expenditure has produced remarkable scientific and engineering achievements. It has widely extended the national research and technology base and has built an infrastructure that can support more and more advanced activities in the space environment.

Under an annual authorization procedure, the Congress has subjected NASA's proposed programs, projects, and research tasks, and their objectives, to intensive review and analysis. Upon approval, the appropriations process then incorporated a further review of NASA's activities, providing a full understanding of the costs required to carry out the approved tasks and meet their objectives. The NASA record of effective management and successful performance is long and exemplary. The achievements include manned and unmanned exploration of the moon, unmanned laboratories on Mars, Venus probes, spacecraft flybys of Jupiter and Saturn, the development and demonstration of communications, meteorological and earth resources satellite technology, and the development of launch systems and other infrastructure to support these and other approved objectives.

The nation has received and continues to realize the benefits that were set forth as justification for the Congressional appropriations. Moreover, greater value has often been received than had been anticipated or hoped for initially. For example, while a 15-unit Saturn V/Apollo vehicle program was originally approved, the national lunar landing goal was achieved in 1969 with the sixth Saturn V launch vehicle. This success provided the opportunity for an additional five lunar exploration missions and the launch of the Skylab space station. The Skylab program demonstrated that man can live and perform useful work in space for extended periods of time.

New programs requiring new technologies have been approved and undertaken as objectives have been attained. Most recently, for example, the space shuttle completed its first operational flight. Older, completed programs have been phased out or shut down. Thus, such facilities as the Saturn 1B launch complexes 34 and 37 have been dismantled, having fulfilled their programmatic purpose and becoming obsolete.

Accounting statements in the Federal budget and in most Federal agencies do not include a balance sheet. Agencies generally do not record depreciation (or capital consumption) allowances or writeoffs for obsolete and no longer used equipment. Thus, since they are the only data available, many observers believe that acquisition costs represent a fair measure of the value of the assets managed or held by a Federal agency. This is an erroneous conception, particularly (but not exclusively) for those obsolete facilities or equipment that currently are worth no more than scrap or salvage value, as would be the case of some of the materials in the hands of NASA. Thus, the Panel concludes that once program objectives have been achieved or a facility has served its intended purpose, the nation has received full value for its expenditure. At that point, the Panel believes the Federal Government's estimate of the currently remaining value of its assets should be determined by their worth in the marketplace, not by what the historical costs may have been to produce them.

For example, the Delta and Atlas Centaur expendable launch systems are being phased out by NASA. Proposals to commercialize these systems could involve a transfer, sale, or lease of existing government assets to a private sector entrepreneur, in which the fair value of the assets could become an issue.

Admittedly, the market for determining an appropriate price for such assets is likely to be "thin," or limited. Despite the difficulties in establishing "fair market value," it is important for the nation to recognize the net benefits that can accrue to the public from such a transfer, sale, or lease of assets. In addition to the specific products and services that might be provided by innovative commercial ventures in space, there would be other benefits such as employment opportunities, increased tax revenues at the state, local, and Federal level, and backup national launch capability to meet currently unforeseen or future emergency needs of NASA or the DOD. This is especially true if the alternative implies that the assets would remain idle.

The Panel recognizes that the Federal Property and Administrative Services (FPAS) Act provides for the disposal of excess and surplus government property, and is concerned that the present law, and regulations issued pursuant thereto, might not provide sufficiently high purchase priority to commerical space ventures, ventures that were not foreseen at the time of enactment. The Panel therefore suggests that consideration be given to either amending the FPAS Act, the regulations, or both, or to obtaining other legislative authority, if such action is needed to provide the authority required to realize continuing public benefits. In any event the Panel strongly believes that the view expressed earlier in this subsection on the value of NASA's no-longer-needed assets should be applied to help encourage and facilitate commercial ventures in space. Aside from the above considerations, the Panel makes no judgment on any proposal other than those views expressed in Sections V and X of this report.

Insurance

Beginning with development and launch of the first commercial synchronous satellite, Early Bird I, the insurance industry, as an outgrowth of its aviation insurance activities, has provided the insurance coverages to support the growing communications satellite industry. First party property coverages, frequently referred to as hull insurance, have been available during ground handling and prelaunch activities as well as during the launch phase.

NASA, with its Delta and Atlas Centaur ELVs, and the space shuttle, has been the launch agent for the commercial communications satellite industry, and in that role it has also administered U.S. government treaty commitments with respect to third party liability. Consequently, NASA has played an active role in insurance and indemnification matters to facilitate the commercialization process. NASA launch service agreements require users to obtain third party liability insurance in amounts agreed to by NASA and the user "in view of the insurance available in the world market at a reasonable premium," not to exceed $500 million of coverage for each launch service. As a practical matter, $500 million has been established as the liability coverage to be obtained by each user.

As the time for conducting commercial activities with the shuttle approached, NASA initiated several actions to assist with the transition to and the utilization of shuttle capabilities. First, in 1979 NASA requested, and the Congress approved, an insurance and indemnity amendment to the Space Act, set forth in Section 308 (a), authorizing NASA to provide liability insurance, and charge the user a fee therefor, or indemnify the user in cases when it is impractical or when a user is unable to obtain adequate insurance. This authority was designed to encourage the use of the space environment by easing the insurance burden for space shuttle activities such as "get-away specials" which involve small experimental packages sponsored by a variety of users. The Section 308 authority also authorizes NASA to indemnify a user in excess of the third party liability coverage obtained, i.e., above $500 million. In addition NASA, with respect to the shuttle, enters into cross-waiver agreements with users providing that each assumes responsibility for its own property without recourse against the other in event of a loss. Thus, a spacecraft owner is indemnified against any shuttle damage caused by the spacecraft and NASA is indemnified against damage to the spacecraft.

Space technology changes rapidly and circumstances change accordingly, introducing new challenges in the insurance process. For example, the shuttle provides new and different capabilities, and communications spacecraft are getting larger, more complex and more expensive. To date, United States expendable launch vehicles have had the capacity for only one communications spacecraft; the shuttle can carry as many as four Delta-class spacecraft. The insurance industry provided the coverage required for the two-spacecraft STS-5 launch. However, there is a present concern that difficulties may be encountered in obtaining coverages for a three or four spacecraft shuttle launch. NASA is now examining this issue with the insurance industry.

Essentially all space insurance requirements have hitherto involved communications spacecraft. Commercialization of other space technologies most likely will introduce different first and third party insurance problems. These must be addressed if the private sector is to invest in space enterprises. Capital will not be put at risk without the availability of insurance to cover hardware losses or to provide indemnification against third party claims. NASA has done a creditable job in initiating actions and in working with the insurance industry to foster an insurance system for space activities. **NASA should not enter into the insurance business. Nevertheless, since NASA is the generator of much of the new space technology and therefore most familiar with the complexities and the implications of it, the Panel believes NASA must continue to inform itself on insurance needs and problems, and to work closely with the insurance industry to seek solutions to insurance barriers to commercialization of space technology.**

Federal Income Tax Considerations

Since the inception of Federal income taxation, it has generally been believed that innovative efforts in society could be induced by the enactment of tax incentives; but it appears that there is little direct quantitative evidence regarding the impact of tax incentives on the rate and timing of R&D and innovation. (See National Science Foundation study, Tax Policy and Investment in Innovation, 1982). It is not the issue whether governmental intervention in support of a market economy is desirable or whether tax incentives even have a favorable effect on innovative activity. The fact is the Federal tax law contains a number of provisions that favor certain types of organizations to encourage activities such as business ventures in space technologies. A brief review of these statutory provisions follows:

- - R&D Expenditures (See Treasury Regs. #1.174-2 (a) (1).) May be deducted currently or capitalized and then amortized over a 60-month period beginning when income is generated from the R&D expenditures.
- - Special Treatment on Sale of Technology Is afforded the individual professional inventor (as opposed, for example, to an author) whose income from the sale of his patent will be taxed at capital gains rates rather than those of ordinary income.
- - Venture Capital Investments in New Technology-Based Firms Can be formed so as to avoid income tax at the corporate level if they are principally engaged in the development or exploitation of inventions, technological improvements, new processes or products not previously available.
- - Small Business Investment Companies (SBICs) While not exclusively limited to technological firms, such investment vehicles offer

substantial tax incentives to investors, and the SBICs have been a substantial underwriter of technology-based ventures.

The Panel believes that in light of the existing special provisions in the Tax Code relating to incentives for technological innovation, no special tax legislation need be enacted to encourage business ventures in space technologies, still a rapidly growing new frontier. The Panel recognizes that the Congress' interest in the broader issue of incentives for innovation will work to the benefit of business ventures in space. Later developments should be carefully audited to determine whether or not the uniqueness of a commercial role in space ventures will suggest a modification of this viewpoint. At this stage is seems unwise to change present options available under our tax system.

VII. Anticompetitive Considerations

Space commercialization ventures do not raise antitrust issues simply because they involve the space environment. Moreover, the fact that these ventures are in an experimental stage and that the experiments are being carried out through joint endeavors with NASA, a government agency, makes it unlikely that antitrust problems will arise. However, as successful development of products and processes in space ventures move into the private sector, consideration should be given to several aspects having antitrust implications, including the need to use the essential space transportation facilities presently owned and controlled by NASA and the capital intensive nature of space ventures. These factors may be instrumental in the creation of market power by a single firm or, what is more likely, necessitate the formation of joint ventures in research and development by large firms that might otherwise be in competition.

The model now being used is the Joint Endeavor Agreement developed by NASA. Such an agreement has been made between NASA and McDonnell Douglas (working with Johnson and Johnson) to conduct research for the manufacture of certain pharmaceuticals during four trips on the space shuttle over a seven year period. NASA entered into this agreement after soliciting offers through a notice in the Federal Register. It agrees to furnish the four trips on the space shuttle without charge. However, it will not offer the same conditions to firms engaged in similar research. McDonnell Douglas pays for the cost of conducting the research and retains exclusive rights to the patents and know-how, except where NASA determines that the subject matter is not being supplied "in sufficient quantity and at reasonable prices to satisfy market needs."

The use of an essential facility, such as the space shuttle, "should be open to all on a nondiscriminatory basis" according to the Department of Justice antitrust division. The Federal Register solicitation by NASA probably meets this requirement. If, in the future, some launch facilities are to be operated by private firms, this "essential facility doctrine" may be a factor to consider from an antitrust standpoint. The concern may be alleviated if these operations are under the supervision of a regulatory agency, either by express or implied exemption from the antitrust laws. Proposed legislation to this effect is presently before Congress.

Like other industrial activities, space commercialization ventures are engaged in a search for technologically innovative products and processes which can be profitably marketed. This search area has been the subject of widespread concern and discussion in recent years because of the perception that United States leadership in this area is being eroded by aggressive initiatives in Japan and western Europe. It is argued that United States antitrust laws are significantly responsible for this state of affairs. The Department of Justice antitrust division issued its Antitrust Guide Concerning Research Joint Ventures in November 1980. This guide seeks to clarify what can and cannot be done. It also refers to its Business Review Procedure whereby joint venturers may obtain an opinion from the Department regarding planned activities. However, many deem this inadequate because the Department makes no enforceable commitment.

As a result, a number of legislative proposals are before Congress which seek to provide certainty for joint research and development ventures. These are of two types. One provides for a Certificate of Review Procedure by the Attorney General, modelled on the Export Trading Company Act of 1982, which protects those getting favorable reviews from criminal and civil antitrust liability. The other sets forth statutory guidelines for obtaining immunity from criminal and civil antitrust liability. Thus, in the first, there is up front clearance by the Attorney General, and in the latter, the venture may be challenged in the courts after its gets under way.

These legislative proposals are a modest step toward removing the uncertainties of the antitrust laws for research and development ventures, including space commercialization projects. The Department of Justice objects to the certificate of review procedure because of its alleged regulatory nature. It urges, instead, that Congress focus on modifying private treble damage action which is said to be the main source of antitrust ligitation. However, the certificate of review procedure seems to be a small departure from the existing business review procedure. It has widespread support and may, at least, help in encouraging industry to proceed with innovative technological projects.

The Panel recognizes that space commercialization projects, in their present experimental stage and in the manner by which NASA is conducting its joint endeavor arrangements with private firms, are not likely to raise antitrust issues. However, since it anticipates that marketable products and processes will be developed and that more controls may move into the private sector, the debate over present uncertainties in the antitrust laws should be monitored.

It supports the legislative objectives, represented by the bills now before Congress, to obtain more certainty in the antitrust laws for joint ventures in research and development. The Panel also recognizes that these specialized measures are only steps in the development of a more coherent body of antitrust law principles than presently exists not only with regard to joint ventures in research and development but also with other aspects which may encourage the growth of economic activity in an international competitive environment.

VIII. Organizing for the Regulatory Process

Except for the Conestoga I launch by Space Services, Inc. on September 9, 1982, United States space operations have been government ventures or subject to a virtually automatic governmental control process because all launch systems and launch sites were government-owned. Commercial activities in space have been limited to communications satellites which fell within the existing regulatory framework of the Federal Communications Commission (FCC). Under these circumstances effective mechanisms existed for assuring the public safety and for complying with the international obligations of the United States set forth in several treaties. (See Appendix 6.) The Outer Space Treaty and the Convention on International Liability for Damage Caused by Space Objects establish two major obligations—first, liability for damage caused by a space object originating from the United States as the launching state which is provided for through the terms of NASA's launch service agreements, and second, the responsibility of the United States to authorize and continually supervise these non-government payload activities in outer space which is satisfied by the FCC's approval requirements for communications satellites.

The United States has also agreed to register with the United Nations all space objects launched from United States territory in accordance with the 1976 Convention on Registration of Objects Launched Into Outer Space. With government controlled launches, this registration requirement has become routine. The more recent Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques was ratified in 1980. It is not considered applicable to commercial communications satellites. The principal public policy concern in the production and sale of a commercial communications satellite to an international organization or a foreign country is compliance with the United States International Traffic in Arms Regulations administered through a Department of State licensing procedure to control the export of sensitive technologies.

Growth and diversification in the commercialization of space technology can be expected to require a different approach to the authorization and supervision process. For example, an Ariane launch of a United States-built domestic communications satellite requires FCC approval and an export license (to a foreign launch site); it also requires the United States to address its obligations under the liability convention, under this new circumstance. Future regulatory needs might be better illustrated by the Conestoga I launch by Space Services, Inc., a private sector venture involving the test of a new launch vehicle from a new launch site. Theoretically, it could have been launching a commercial payload designed for any number of purposes. Multiple agency clearances were required for that launch including:

- o an export license issued by the State Department to satisfy munitions export control requirements;
- o a Federal Aviation Administration authorization to utilize air space above and around the launch site;
- o an FCC radio frequency allocation for launch monitoring;
- o a destructive device (rocket) registration with the Alcohol, Tobacco, and Firearms unit of the Treasury Department;
- o an Internal Revenue Service filing;
- o a launch notification to the North American Air Defense Command.

In the process of granting these clearances, the government had to assure that United States treaty obligations were satisfied. This is clearly a laborious and, in this particular case, an expensive process. In addition to those considerations introduced by a potential commercial expendable launch vehicle operation, the anticipation of new types of commercial payloads, other than communications spacecraft, further underscores the need for an inspection, control and approval system. The government must assure that its national security, foreign policy, public safety and treaty obligations are met.

Although a user-conducted multiple agency clearance process has been adequate to this point, it is expected that a more formal and centralized government clearance arrangement will ultimately become necessary to facilitate space commercialization activities. Legislation introduced in the Congress and interagency reviews are expected to explore this issue to determine the most appropriate methods of addressing the matter. **The Panel believes, however, that NASA should not be placed in a regulatory or central clearance role with respect to space commercialization initiatives. Other agencies are better suited for this task and it is important that NASA avoid a conflict of interest, either imagined or real, with its R&D responsibilities. Nevertheless, NASA should encourage and support simplification of the clearance system. Further, because of its expertise in space technology, NASA should be prepared to provide technical advice and support to any other agency participating in or having a regulatory role in space commercialization activity. It should also assist commercial organizations seeking clearances to exploit a NASA technology.**

IX. Addressing National Security Concerns

Since its inception NASA has had as one of its major responsibilities the support of U.S. military objectives in space. Conversely, national defense agencies are obligated under the Space Act to provide to NASA information from military space activity which may be of value to the civilian program. The first of the several goals enunciated in the National Space Policy is to "strengthen the security of the United States." That statement, in dealing with the Space Transportation System, also indicates that "Launch priority will be provided for national security missions."

Commercialization activities are encouraged under the present policy but must be "consistent with national security concerns." Because the interest in commercialization is relatively new, there is little experince to guide private firms undertaking new initiatives in space. It seems evident, therefore, that one of the Federal Government's first responsibilities in encouraging private investment is to clarify the basis for determining what constitutes a "national security concern."

Shuttle customers, for example, will obviously want to know the odds for being preempted by a military payload priority. At the present time the risks of such preemption are said to be slight, and commercial users are advised that preemption will be exercised only when absolutely necessary and after full consideration of the potential adverse effect on a commercial venture.

The determination of whether a potential commercial enterprise involves national security concerns or conflicts that would preclude private sector development is an interagency matter. It falls under the purview of the Senior Interagency Group on Space (SIG) chaired by the Assistant to the President for National Security Affairs. NASA, as a member of SIG, should assume a lead role in representing the case for commercialization of space technologies and pursue the identification and publicizing of the criteria by SIG for determining the acceptability of proposed ventures.

X. Guidelines for NASA Evaluation of Commercialization Proposals

NASA has received proposals for the commercialization of space technology covering a wide variety of activities. Because of the variety of applications and the differing technologies involved, it is essential for NASA to have flexibility in the evaluation process and in the mechanisms adopted for NASA support to or participation in an endeavor. On the other hand, there is a need for uniform guidance and a common understanding of the evaluation process to assure fair and equal treatment and to help NASA make rational, consistent and expeditious judgments on proposals. Accordingly, the Panel suggests some general principles to guide the NASA evaluation process. These principles are followed by two sets of guidelines addressing the mechanisms of the evaluation process. These are designated as policy considerations and specific requirements. (Nothing in this section should be interpreted as a modification of or substitution for United States commitments to foreign governments or international organizations with respect to international cooperation in the development and application of space science and technology.)

General Principles

-- Equal opportunity should be assured for all United States firms and citizens to participate in the development, utilization, and exploitation of space technology.

-- Each proposal should be subjected to a uniform review procedure with defined processing phases.

-- Each proposal must put capital or other private resources at risk.

-- Commercial criteria, not NASA or the goverment as a whole, should determine the success or failure of a proposal.

- NASA should be completely candid, and should provide a prompt and authoritative response to a proposal in order that business decisions can be made expeditiously on the basis of reliable information.
- NASA, except where a clear and identifiable public interest demands it, should not compete with the private sector. It should commit to this principle on a specific undertaking for specific periods of time in order to foster a climate of stability and continuity for business decisions. The nature and extent of any such exceptions should be specifically defined.
- Since unique and expensive goverment-owned facilities often play a vital role in space activity, NASA should develop and maintain a well-defined policy with respect to the availability, use and cost of such facilities for commercial endeavors.
- NASA should take an active role in resolving problems affecting commercialization proposals with multi-agency implications.

Policy Considerations

These considerations are designed to facilitate a timely decision that a proposal should be processed or rejected. If a proposal does not pass this initial screening, the proposer should be so advised and no time or effort should be devoted to a formal evaluation of the proposal. For example, if there is a national security bar to a proposed commercial activity, it should be so stated and further processing terminated.

- The extent to which a proposed endeavor would affect a present or future governmental activity, or foreign policy interest:

- - Is it realistic to commercialize or to support the commercialization of an activity which, due to a priority interest in the government, would preclude the creation and exploitation of a market through the use of risk capital?

- - Is it possible to separate out the critical governmental interest for retention by the Government while releasing the remaining portions of the activity for commercialization? Such a determination should assure that the government and the private sector are not placed in competition.

- - If immediate commercialization is not practical because of an overriding government interest, is future commercialization possible when technology advances or national security concerns change?

- The extent to which a proposal serves the public interest by meeting one or more of the following criteria:

- - Does the proposal promise to enhance the national research and technology base through scientific experimentation or through the performance of R&D to advance the state of space technology and apply it to the commercial marketplace?

- - Is the proposal designed to use space technology to create products or services that, given success, would produce employment opportunities, tax revenues and other economic benefits over a period of time?

- - Does the proposal offer contributions to the general health of the population through technology advances?

- - Will proposals for using space technology and/or the space environment provide benefits to the general public in education, culture, recreation and/or entertainment?

- - Is the proposal designed so as to prevent clutter or debris in the space environment to the detriment of other activities?

Specific Requirements

This category is intended to provide guidance in determining the adequacy of a specific proposal to achieve a desired result and to form a basis for negotiating NASA participation in or support for the proposed activity. The assessment of these factors will be a key determinant of the nature and degree of assistance or incentive NASA might offer and for deciding when NASA should disengage from a joint endeavor.

- - The proposed activity should be technically feasible, i.e., should not be inconsistent with any fundamental principles of science and engineering.

- - The management and technical capability of the proposer and the work program should be sufficiently delineated to judge its adequacy for carrying out the work involved.

- - The proposal should clearly establish the financial responsibility of the proposer and the availability of other resources to carry the proposal to completion.

- - The facility requirements should be identified and a plan for satisfying such requirements should be provided.

- - In those proposals requesting government support, the tangible or intangible offsetting benefits to the nation should be clearly stated and credible.

- The proposal should specify to what extent and how the government would be indemnified against losses due to the proposer's negligence or failure to perform.
- Solutions should be proposed to any problems presented to NASA in honoring requests for the protection of proprietary information and processes.
- The proposal should provide for an appropriate allocation of rights in inventions and proprietary information.
- Any foreign policy and national security implications should be identified, and realistic approaches should be proposed to assure that a commercial activity is, and will remain, consistent with such requirements.

Appendix 1

Panel on Encouraging Business Ventures in Space Technologies

Stover L. Babcock, Jr., Vice President of Tucker Anthony and R. L. Day, New York; formerly Vice President, Merrill Lynch, Pierce, Fenner & Smith; ten years of prior experience in corporate finance, marketing and strategic business development.

Richard H. Bolt, Chairman, Bolt Beranek and Newman Inc., Cambridge, MA, 1953-76, Emeritus; Professor of Acoustics and other positions, Massachusetts Institute of Technology, 1939-70; Associate Director, NSF, 1960-63; Principal Consultant, biophysical science, NIH, 1957-60.

Samuel M. Cohn, Vice President, Robert R. Nathan Associates, Washington, D. C.; Chief Economist, Chief of Fiscal Analysis, Deputy Assistant Director for Budget Review, Bureau of the Budget, 1947-66; Assistant Director, Office of Management and Budget, 1966-73. *

Emilio Q. Daddario, Attorney-at-law, Wilkes, Artis, Hedrick and Lane, Washington, D. C.; Member, United States House of Representatives, 1959-71; Director, Office of Technology Assessment, U.S. Congress, 1973-77. *

Harold B. Finger, President and Chief Executive Officer, U.S. Committee for Energy Awareness, Washington, D.C.; Associate Administrator for Organization and Management, NASA, 1967-69; Assistant Secretary for Research and Technology, HUD, 1969-72; Staff Executive, General Electric Company, 1972-83. *

Peter C. Goldmark, Jr., Executive Director, The Port Authority of New York and New Jersey; Executive Assistant to the Mayor of New York, 1970; Secretary of Human Services, Massachusetts, 1971-75; Director of the Budget, State of New York, 1975-77. *

John A. Johnson, consultant, Washington, D. C.; General Counsel, NASA, 1958-63; Vice President, international, COMSAT, 1964-73; President, and Chairman COMSAT General Corp. 1973-80; Chairman, Satellite Television Corp., 1980-81.

Philip M. Klutznick, (Chairman) Senior Partner, Klutznick Investments, Chicago; former limited partner, Salomon Bros.; member U.S. delegations to United Nations, 1957, 1961, 1962 with rank of ambassador; U.S. Secretary of Commerce, 1979-80. *

Gerald J. Mossinghoff, U.S. Commissioner of Patents and Trade Marks; Deputy Director Legislative Affairs; and staff positions in Office of General Counsel leading to position of Deputy General Counsel, NASA, 1978-81.

Mitchell Rogovin, (Vice-Chairman) Senior partner, Rogovin, Stern and Huge, Washington, D. C.; Assistant Attorney General of U.S., 1966-69; partner, Arnold and Porter, 1969 - 76; Special Counsel to the Director of Central Intelligence, 1975-76. *

Thomas O. Paine, Thomas O. Paine, Associates, Los Angeles; Deputy Administrator, then Administrator, NASA, 1968-70; Senior Vice President, General Electric, 1970-76; President, Northrop Corp. 1976-79.

Staff - Erasmus H. Kloman, (Project Director) Senior Research Associate, National Academy of Public Administration
Craig Voorhees, Research Associate
Debra Kearse, Project Secretary

* Academy Member

EMBARGOED FOR RELEASE AT 10:00 A.M., PACIFIC TIME, JULY 4, 1982

Office of the White House Press Secretary

THE WHITE HOUSE

FACT SHEET

National Space Policy

The President announced today a national space policy that will set the direction of US efforts in space for the next decade. The policy is the result of an interagency review requested by the President in August 1981. The ten-month review included a comprehensive analysis of all segments of the national space program. The primary objective of the review was to provide a workable policy framework for an aggressive, farsighted space program that is consistent with the Administration's national goals.

As a result, the President's Directive reaffirms the national commitment to the exploration and use of space in support of our national well-being, and establishes the basic goals of United States space policy which are to:

—strengthen the security of the United States;

—maintain United States space leadership;

—obtain economic and scientific benefits through the exploitation of space;

—expand United States private sector investment and involvement in civil space and space related activities;

—promote international cooperative activities in the national interest; and

—cooperate with other nations in maintaining the freedom of space for activities which enhance the security and welfare of mankind.

The principles underlying the conduct of the United States space program, as outlined in the Directive are:

- The United States is committed to the exploration and use of space by all nations for peaceful purposes and for the benefit of mankind. "Peaceful purposes" allow activities in pursuit of national security goals.

- The United States rejects any claims to sovereignty by any nation over space or over celestial bodies, or any portion thereof, and rejects any limitations on the fundamental right to acquire data from space.

- The United States considers the space systems of any nation to be national property with the right of passage through and operation in space without interference. Purposeful interference with space systems shall be viewed as an infringement upon sovereign rights.

- The United States encourages domestic commercial exploitation of space capabilities, technology, and systems for national economic benefit. These activities must be consistent with national security concerns, treaties and international agreements.

- The United States will conduct international cooperative space-related activities that achieve scientific, political, economic, or national security benefits for the nation.

- The United States space program will be comprised of two separate, distinct and strongly interacting programs-- national security and civil. Close coordination, cooperation and information exchange will be maintained among these programs to avoid unnecessary duplication.

- The United States Space Transportation System (STS) is the primary space launch system for both national security and civil government missions. STS capabilities and capacities shall be developed to meet appropriate national needs and shall be available to authorized users -- domestic and foreign, commercial and governmental.

- The United States will pursue activities in space in support of its right of self-defense.

- The United States will continue to study space arms control options. The United States will consider verifiable and equitable arms control measures that would ban or otherwise limit testing and deployment of specific weapons systems, should those measures be compatible with United States national security.

SPACE TRANSPORTATION SYSTEM

The Directive states that the Space Shuttle is to be a major factor in the future evolution of United States space programs, and that it will foster further cooperative roles between the national security and civil programs to insure efficient and effective use of national resources. The Space Transportation System (STS) is composed of the Space Shuttle, associated upper stages, and related facilities. The Directive establishes the following policies governing the development and operation of the Space Transportation System:

- The STS is a vital element of the United States space program, and is the primary space launch system for both United States national security and civil government missions. The STS will be afforded the degree of survivability and security protection required for a critical national space resource. The first priority of the STS program is to make the system fully operational and cost-effective in providing routine access to space.

- The United States is fully committed to maintaining world leadership in space transportation with a STS capacity sufficient to meet appropriate national needs. The STS program requires sustained commitments by each affected department or agency. The United States will continue to develop the STS through the National Aeronautics and Space Administration (NASA) in cooperation with the Department of Defense (DoD). Enhancement of STS operational capability, upper stages and methods of deploying and retrieving payloads should be pursued, as national requirements are defined.

- United States Government spacecraft should be designed to take advantage of the unique capabilities of the STS. The completion of transition to the Shuttle should occur as expeditiously as practical.

- NASA will assure the Shuttle's utility to the civil users. In coordination with NASA, the DoD will assure the Shuttle's utility to national defense and integrate national security missions into the Shuttle system. Launch priority will be provided for national security missions.

- Expendable launch vehicle operations shall be continued by the United States Government until the capabilities of the STS are sufficient to meet its needs and obligations. Unique national security considerations may dictate developing special purpose launch capabilities.

- For the near term, the STS will continue to be managed and operated in an institutional arrangement consistent with the current NASA/DoD Memoranda of Understanding. Responsibility will remain in NASA for operational control of the STS for civil missions and in the DoD for operational control of the STS for national security missions. Mission management is the responsibility of the mission agency. As the STS operations mature, the flexibility to transition to a different institutional structure will be maintained.

- Major changes to STS program capabilities will require Presidential approval.

THE CIVIL SPACE PROGRAM

In accordance with the provisions of the National Aeronautics and Space Act, the Directive states that the civil space program shall be conducted:

--To expand knowledge of the Earth, its environment, the solar system and the universe;

--to develop and promote selected civil applications of space technology;

--to preserve the United States leadership in critical aspects of space science, applications and technology; and

--to further United States domestic and foreign policy objectives.

The Directive states the following policies which shall govern the conduct of the civil space program:

- United States Government programs shall continue a balanced strategy of research, development, operations, and exploration for science, applications and technology. The key objectives of these programs are to: (1) preserve the United States preeminence in critical space activities to enable continued exploitation and exploration of space; (2) conduct research and experimentation to expand understanding of: (a) astrophysical phenomena and the origin and evolution of the universe through long-lived astrophysical observation; (b) the Earth, its environment, its dynamic relation with the Sun; (c) the origin and evolution of the solar system through solar, planetary, and lunar sciences and exploration; and (d) the space environment and technology to advance knowledge in the biological sciences; (3) continue to explore the requirements, operational concepts, and technology associated with permanent space facilities; (4) conduct appropriate research and experimentation in advanced technology and systems to provide a basis for future civil applications.

- The United States Government will provide a climate conducive to expanded private sector investment and involvement in space activities, with due regard to public safety and national security. These space activities will be authorized and supervised or regulated by the government to the extent required by treaty and national security.

- The United States will continue cooperation with other nations in international space activities by conducting joint scientific and research programs, consistent with technology transfer policy, that yield sufficient benefits to the United States, and will support the public, nondiscriminatory direct readout of data from Federal civil systems to foreign ground stations and the provision of data to foreign users under specified conditions.

- The Department of Commerce, as manager of Federal operational space remote sensing systems, will: (1) aggregate Federal needs for these systems to be met by either the private sector or the Federal government; (2) identify needed research and development objectives for these systems; and (3) in coordination with other departments or agencies, provide regulation of private sector operation of these systems.

THE NATIONAL SECURITY SPACE PROGRAM

The Directive states that the United States will conduct those activities in space that it deems necessary to its national security. National security space programs shall support such functions as command and control, communications, navigation, environmental monitoring, warning, surveillance and space defense. The Directive states the following policies which shall govern the conduct of the national security program:

- Survivability and endurance of space systems, including all system elements, will be pursued commensurate with the planned use in crisis and conflict, with the threat, and with the availability of other assets to perform the mission. Deficiencies will be identified and eliminated, and an aggressive, long-term program will be undertaken to provide more-assured survivability and endurance.

- The United States will proceed with development of an anti-satellite (ASAT) capability, with operational deployment as a goal. The primary purposes of a United States ASAT capability are to deter threats to space systems of the United States and its Allies and, within such limits imposed by international law, to deny any adversary the use of space-based systems that provide support to hostile military forces

- The United States will develop and maintain an integrated attack warning, notification, verification, and contingency reaction capability which can effectively detect and react to threats to United States space systems.

- Security, including dissemination of data, shall be conducted in accordance with Executive Orders and applicable directives for protection of national security information and commensurate with both the missions performed and the security measures necessary to protect related space activities.

INTER-PROGRAM RESPONSIBILITIES

The Directive contains the following guidance applicable to and binding upon the United States national security and civil space programs:

- The national security and civil space programs will be closely coordinated and will emphasize technology sharing within necessary security constraints. Technology transfer issues will be resolved within the framework of directives, executive orders, and laws.

- Civil Earth-imaging from space will be permitted under controls when the requirements are justified and assessed in relation to civil benefits, national security, and foreign policy. These controls will be periodically

- The United States Government will maintain and coordinate separate national security and civil operational space systems when differing needs of the programs dictate.

POLICY IMPLEMENTATION

The Directive states that normal interagency coordinating mechanisms will be employed to the maximum extent possible to implement the policies enunciated. A Senior Interagency Group (SIG) on Space is established by the Directive to provide a forum to all Federal agencies for their policy views, to review and advise on proposed changes to national space policy, and to provide for orderly and rapid referral of space policy issues to the President for decisions as necessary. The SIG (Space) will be chaired by the Assistant to the President for National Security Affairs and will include the Deputy Secretary of Defense, Deputy Secretary of State, Deputy Secretary of Commerce, Director of Central Intelligence, Chairman of the Joint Chiefs of Staff, Director of the Arms Control and Disarmament Agency, and the Administrator of the National Aeronautics and Space Administration. Representative of the Office of Management and Budget and the Office of Science and Technology Policy will be included as observers. Other agencies or departments will participate based on the subjects to be addressed.

BACKGROUND

In August 1981, the President directed a National Security Council review of space policy. The direction indicated that the President's Science Advisor; Dr. George Keyworth, in coordination with other affected agencies, should examine whether new directions in national space policy were warranted. An interagency working group was formed to conduct the study effort and Dr. Victor H. Reis, , an Assistant Director of the Office of Science and Technology Policy was designated as Chairman. The group addressed the following fundamental issues: (1) launch vehicle needs; (2) adequacy of existing space policy to ensure continued satisfaction of United States civil and national security program needs; (3) Shuttle organizational responsibilities and capabilities; and, (4) potential legislation for space policy. The reports on the various issues formed the basis of the policy decisions outlined here. The following agencies and departments participated: State, Defense, Commerce, Director of Central Intelligence, Joint Chiefs of Staff, Arms Control and Disarmament Agency and the National Aeronautics and Space Administration, as well as, the National Security Council Staff and the Office of Management and Budget.

Appendix 3

Meteorological and Land Remote Sensing (Landsat) Satellite Systems

This appendix presents background and current status of the meteorological and land remote sensing satellite systems developed by NASA and subsequently transferred for operation to the National Oceanic and Atmospheric Administration (NOAA), Department of Commerce(DOC). NASA continues advanced instrumentation R&D to increase the capability of these space systems. The Panel examined the history of these applications of space technology to identify any characteristics of significance to its study. Operation of these satellite systems remains a governmental function in NOAA; however, several studies have recently been completed with respect to future operational modes, and NOAA announced a Presidential decision on March 8, 1983, to offer both systems for sale to the private sector. The Panel considers the status of these operational systems to be outside the scope of its study for NASA.

Meteorological Satellite Systems

Meteorological and communications satellite systems were early and successful NASA initiatives in the application of space technology. Tiros I was launched April 1, 1960, and Syncom II, July 26, 1963. Responsibility for the operational use of communications satellite technology was transferred to the private sector by the Communications Satellite Act of 1962, placing it in the traditional arena for the communications function in the United States.

Meteorological satellites were integrated with the existing weather service, a governmental function since 1870, to provide a new and unique capability for weather forecasting and research. The program is operated under a long standing

NASA/DOC/NOAA interagency agreement, originated in 1962, covering both the Tiros/NOAA series of polar orbiting satellites and the series of geostationary orbit satellites. NASA performs R&D on advanced spacecraft and sensors, transfers new systems to NOAA after completing engineering evaluation, and procures and launches all operational spacecraft for NOAA on a reimbursable basis. NOAA finances and operates the operational system through its National Environmental Satellite, Data, and Information Service.

In recent months, at least one proposal was presented to take over and operate the existing civil meteorological satellite systems as a commercial venture. Studies of private sector operation were conducted in the Executive Branch. Private sector operation introduces several issues including popular expectations of services resulting from a historical govermental function, international commitments to furnish satellite data, and the ability to meet United States government meteorological requirements. Whether such operation, relying heavily on government purchase of data, represents commercialization of space technology or is in effect a contracting out of government functions is open to debate. In contrast to the ELV circumstances where the government is phasing out because its ELV requirements will eventually terminate, the meteorological satellites represent a continuing operational need for a service traditionally rendered by the government.

As noted above, a decision has recently been made to offer these systems for sale either as a package with the Landsat system or separately.

Land Remote Sensing (Landsat) Satellite System

The land remote sensing system, Landsat, is a development initiated by NASA to acquire data to assist in the management of the Earth's resources. Landsat 1, the first spacecraft, was launched in 1972. Its two instruments, a multispectral scanner (MSS) and a return beam vidicon camera, provided experimental data on a variety of subjects including geologic features, land use, agricultural crops, hydrology and water pollution. Landsat 2, identical to Landsat 1, and Landsat 3, with some added capability in both instruments, were subsequently launched to provide data continuity to an increasing number of ground stations including eleven in eleven foreign countries. The system is operated on an "open skies" policy and data is provided to foreign ground stations in accordance with a NASA cooperative agreement for a $600,000 annual fee. Until recently, this fee was a nominal $200,000. NASA continued R&D on advanced space and ground systems designed to improve data acquisition capability and to enhance ground processing of the data. Landsat 4, with a new instrument, the thematic mapper, and a multispectral scanner was launched in 1982. A second Landsat 4 spacecraft is nearing completion and will be placed in storage.

Even though it was an experimental system, soon after the Landsat capability was demonstrated several issues arose including continuity of data, establishment of an operational system, market aggregation (diversity of users, type of desired coverage, and location), system subsidy, and transfer of the remote sensing function to the private sector. Many studies were conducted, bills were introduced in the Congress and several hearings were held, and at least one private sector firm proposed to take over the operation. An Office of Science and Technology Policy review completed in 1979 resulted in a Presidential directive designating NOAA as the single agency to manage the operational land remote sensing system. The directive also required NOAA to seek ways to achieve eventual operation by the private sector. Effective February 1, 1983 NASA transferred the operation and management of the Landsat system to the NOAA National Environmental Satellite, Data and Information Service. This transfer included all spacecraft and ground facilities except for the thematic mapper instrument on Landsat 4 which is still undergoing engineering evaluation by NASA. NASA will continue to perform R&D on new instruments. The present NASA/NOAA arrangement closely parallels the one established for the meteorological satellites.

The need for funds in the Federal budget to procure follow-on spacecraft to provide data continuity after the two Landsat 4s caused further examinations of mechanisms to transfer civil land remote sensing systems to the private sector. The issue was placed before the Cabinet Council on Commerce and Trade, chaired by the Secretary of Commerce. The Secretary of Commerce also formed an advisory committee of non-federal experts and an interagency program board to advise on Landsat commercialization. In response to an inquiry from the private sector, these examinations were broadened to include concurrent commercialization of the meteorological satellite systems. In addition to these Executive Branch reviews, the 1982 legislation (P.L. 97-324) authorizing NOAA to operate the Landsat system required the Secretary of Commerce to conduct a series of studies and report to the Congress. The submission date for the last report was April 1, 1983.

The Presidential decision announced on March 8, 1983, proposes to offer the Landsat system for sale to the private sector either separately or in conjunction with the civil meteorological satellite systems.

Appendix 4

NASA GUIDELINES REGARDING EARLY USAGE OF SPACE FOR INDUSTRIAL PURPOSES

NASA, by virtue of the National Aeronautics and Space Act of 1958, is directed to conduct its activities so as to contribute to the preservation of the role of the United States as a leader in aeronautical and space science and technology and their applications.

Since substantial portions of the United States technological base and motivation reside in the United States private sector, NASA will enter into transactions and take necessary and proper actions to achieve the objective of national technological superiority through joint action with United States domestic concerns. These transactions and actions will be undertaken in the context of stated NASA program objectives and after a determination by the Administrator. They may include, but are not limited to: (1) engaging in joint arrangements with United States domestic concerns in research programs directed to the development of enhancement of United States commercial leadership utilizing the space environment; (2) conducting research programs having as an end objective the enhancement of United States capability by developing space-related high-risk or long-lead-time technology; and (3) by entering into transactions with United States concerns designed to encourage the commercial availability of products of NASA space flight systems.

NASA incentives for these purposes may include in addition to making available the results of NASA research : (1) providing flight time on the space transportation system on appropriate terms and conditions as determined by the Administrator; (2) providing technical advice, consultation, data, equipment and facilities to participating organizations; and (3) entering into joint research and demonstration programs where each party funds its own participation.

In making the necessary determination to proceed under this policy, the Administrator will consider the need for NASA funded support to commercial endeavors and the relative benefits to be obtained from such endeavors.

As major areas for NASA enhancement of total United States capability, including the private sector, may become apparent from time to time, the factors to be considered by NASA prior to providing incentives may include, but not be limited to, some or all of the following considerations: (1) the public or social need for the expected technology development; (2) the contribution to be made to the maintenance of United States technological superiority; (3) possible benefits accruing to the public or the United States Government from sharing in results; (4) the enhanced economic exploitation of NASA capabilities such as the space transportation system; (5) the desirability of private sector involvement in NASA programs; (6) the merit of the research, development or application proposed; (7) the degree of risk and financial participation by the commercial concern; (8) the amount of proprietary data or background information to be furnished by the concern; (9) the rights in data to be granted the concern in consideration of its contribution; (10) the ability of the concern to project a potential market; (11) the willingness and ability of the concern to market and sell any resulting new or enhanced products on a reasonable basis; (12) the impact of NASA sponsorship on a given industry; (13) provision for a form of exclusivity in special cases when needed to promote innovation; (14) recoupment of the NASA contribution under appropriate circumstances; and (15) support of socio-economic objectives of the Government.

/S/Robert A. Frosch
Robert A. Frosch
Administrator

June 25, 1979
Date

Appendix 4
(Continued)

NASA/INDUSTRY WORKING RELATIONSHIPS

NASA has developed three basic levels of working relationships with private organizations. These provide the flexibility needed to meet a wide range of needs from large organizations with strong research departments to small entrepreneurial firms that want to develop a product for the market. They also provide for incremental increases in understanding and commitment by the parties. In all cases, the Government does not fund any of the work done by the firm, but rather each party funds its own activities separately.

JOINT ENDEAVOR AGREEMENT (JEA)

The JEA is a cooperative arrangement in which private participants and NASA share common program objectives, program responsibilities, and financial risk. The objective of a JEA is to encourage early space ventures and demonstrate the usefulness of space techology to meet marketplace needs. A JEA is a legal agreement between equal partners, and is not a procurement action; no funds are exchanged between NASA and the industrial partner. A private participant selects an experiment and/or technology demonstration for a joint endeavor which complies with MPS program objectives, conducts the necessary ground investigation, and develops flight hardware at company expense. As incentive for this investment, NASA agrees to provide free Shuttle flights for projects which meet certain basic criteria, such as technical merit, contribution to innovation, and acceptable business arrangements. As further incentive, the participant is allowed to retain certain proprietary rights to the results, particularly the nonpatentable information that yields a competitive edge in marketing products based on MPS results. However, NASA receives sufficient data to evaluate the significance of the results, and requires that any promising technologies be applied commercially on a timely basis, or published.

TECHICAL EXCHANGE AGREEMENT (TEA)

For companies interested in applying microgravity technology, but not ready to commit to a specific space flight experiment or venture, NASA has developed TEA. Under a TEA, NASA and a company agree to exchange technical information and cooperate in the conduct and analysis of ground-based research programs. In this agreement, a firm can become familiar with microgravity technology and its applicability to the company product line at minimal expense. Under TEA, the private company funds its own participation, and derives direct access to and results from NASA facilities and research, with NASA gaining the support and expertise of the private company's industrial research capability.

INDUSTRIAL GUEST INVESTIGATORS (IGI)

In an IGI agreement, NASA and industry share sufficient mutual scientific interest that a company arranges for one of its scientists to collaborate (at company expense) with a NASA-sponsored principal investigator on a space flight MPS experiment. Once the parties agree to the contribution to be made to the objectives of the experiment, the IGI becomes a member of the investigation team, thus adding industrial expertise and insight to the experiment.

Appendix 5

PROTECTING INTELLECTUAL PROPERTY IN SPACE ACTIVITIES

BY

GERALD J. MOSSINGHOFF

ASSISTANT SECRETARY OF COMMERCE AND
COMMISSIONER OF PATENTS AND TRADEMARKS

In this paper, I will discuss the arrangements which have been adopted by NASA to protect intellectual property in space endeavors.

Patent Provisions of the Space Act

In the climate that existed when the Space Act was enacted, Congress was reluctant to allow contractors of the new civilian agency to acquire rights to inventions made under contract without some safeguards to protect the public investment in this new and unknown area of technological activity. Thus, the patent provisions of the Space Act, which were agreed to by the U.S. House of Representatives and the Senate and which appear in section 305 of the Space Act,[1] attempted to strike a balance between the government's interest and the need to spur private initiative and innovation.

A basic tenet of section 305 is that all rights vest in the United States for any invention "made in the performance of any work under any contract" of NASA, unless all or any part of such rights are waived by the Administrator of NASA. The statutory authority for granting waivers is very broad, requiring only that a determination be made that "the interests of the United States will be served" by such waiver.

NASA was mindful that flexibility was needed in implementing section 305 in order to encourage maximum industrial participation in its activities and the application of innovative technology to its programs. But it was faced with very little guidance on how to interpret the new section 305. It, thus, was confronted with two immediate issues: (1) the development of an appropriate waiver policy and (2) a reasonable interpretation of the types of contracts to which the stringent title-vesting provisions of section 305 were to be applied.

As to the first issue, after less-than-satisfactory attempts to develop waiver criteria based on the type of technology involved, NASA helped to formulate and then adopted the government-wide Presidential Memorandum and Statement of Government Patent Policy of 1963[2] as a guide in specifying the criteria for waiver grant. Following this Memorandum and Statement, NASA's waiver regulations have since 1964 specified that waiver of commercial rights may be granted either at the time of contracting (for all inventions which may be made under the contract) or for an identified invention actually made and reported under contract, provided the requisite findings essentially as set forth in the Memorandum and Statement can be made.[3]

Overall, the NASA waiver process has been flexible. In instances where waiver of rights is requested, the percentage of grants in recent years has been very high, approximately 90%. And while the processing of waivers does involve some delays, NASA does not believe that there has been any harmful delays of procurement actions or patent filings.

In deciding the second issue — that is, the types of contracts subject to section 305 treatment — NASA has consistently made administrative interpretations that many agreements, understandings or arrangements were not "contracts" for the purposes of section 305. That term was construed as not applying, for example, to proposals submitted to NASA; contracts for supplies, construction or utility services; launch service agreements (where NASA provides services for another party on a reimbursable basis); use of NASA facilities (such as wind tunnels); use of satellite data; exchange of technical information and joint contributions of hardware to a common program. An analysis of these activities indicates a common factor: they did not involve the performance of work of an inventive type for NASA. It has, therefore, been NASA's long-standing administrative interpretation of section 305 that the contracts, agreements, understandings or arrangements to which it applies are those for the performance of work of an inventive type (i.e., design, engineering, development, research or experimental work) for NASA. This interpretation, in turn, has permitted NASA to be very flexible in dealing with patent rights as they relate to encouraging private commercial participation in space.

Rights in Technical Data

Rights to valuable technical, commercial and financial information (i.e., "data") are in some instances more important than patent rights when considering commercial participation in space. NASA's policies with respect to rights to data involved in contract performance are not subject to express statutory requirements as are rights to inventions made under contract. There are, however, collateral statutory provisions, such as section 203 (a) (3) of the Space Act and the Freedom of Information Act,[4] that must be considered in implementing and applying these policies.

As far as procurement contracts are concerned, including those contracts which may also be subject to section 305 regarding patent rights, it is NASA policy normally to acquire data first produced in the performance of the contract without restriction regarding its publication, use or disclosure, i.e., with "unlimited rights." It is also NASA policy not to acquire "protectible" data unless necessary, but, if necessary, to acquire data under express agreement or understanding not to use or disclose it in a manner that would compromise its value as an intellectual property right, i.e., to acquire it with limited or "restricted rights." Care is taken to agree to protect only that data (whether in a proposal, submitted under contract or pursuant to any other arrangement) which can be protected under law, but once agreed to, maximum protection is assured. However, in order to reduce administrative burdens and legal risks, as an overriding consideration it is NASA policy not to acquire protectible data unless there is a real need for it.

NASA's policies with respect to copyright subsisting in data produced under contract must be considered in conjunction with its data policies. As a general rule, permission from NASA is required for a contractor to assert or establish a claim to copyright subsisting in data first produced under contract. Such permission is (1) granted automatically at the time of contracting for scientific and technical articles based on work performed under contract and published in academic or technical journals and (2) granted liberally in other situations upon request.

Since NASA's policies regarding data rights and copyrights involved in contract performance are not subject to express statutory requirement as are invention rights, there is no need to make any distinction between those "contracts" that are subject to section 305 and those that are not for the purpose of considering such rights. Thus, as a practical matter NASA negotiates data rights and copyrights in non-procurement transactions to fit the circumstances. The only statutory precautions are to assure that agreements regarding such rights are consistent with section 203 (a) (3) of the Space Act and the Freedom of Information Act.

Commercial Activities in Space

As the Space Shuttle became a reality, both NASA and the private sector were well aware of its potential as a facility that could be made available for commercial activities. Obviously, it could replace expendable launch vehicles for placing free-flying payloads into orbit, e.g., geostationary communications satellites. But an even greater potential was created: the Shuttle and the contained Spacelab, developed by the European Space Agency, is a true space-borne laboratory for the conduct of experiments, demonstrations or possibly ongoing commercial operations for processing materials in a zero-gravity, near-perfect vacuum environment.

There was an early appreciation that special policies had to be formulated if the vast potential that this new capability represented was to be realized. As a result, NASA conducted two significant studies: one to explore the legal and policy issues regarding joint programs with industry to bridge the gap between government-funded demonstrations and fully reimbursable commercial activities and one to explore the status of inventions under any gap-filler demonstrations if they were to be carried out.[5] The result of the first study was that NASA could enter into diverse and flexible arrangements (other than conventional procurement contracts) with the private sector as part of its statutory mandates. The result of the second study made it clear that when properly structured such arrangements were not "contracts" covered by section 305 (a) of the Space Act.

NASA's intent actively to encourage commercial participation in the space program is fully reflected in the 1979 Guidelines Regarding Joint Endeavors with U.S. Domestic Concerns in Materials Processing in Space. In general, a joint endeavor is an arrangement between NASA and a private party in which each undertakes to contribute to or participate in a project of mutual benefit. It usually involves the use of equipment, facilities, services, personnel or information made available by one of the parties for use by the other. Such endeavors do not involve the transfer of funds or title to property between the parties and are not considered procurement or assistance agreements. Services which may be involved do not constitute the employment of one of the parties' employees by the other.

Since it had been previously established that a joint endeavor, as thus defined, was not a "contract" subject to section 305 (a) of the Space Act, NASA was free to negotiate intellectual property rights in a manner consistent with the policy of encouraging active commercial participation in space. Since joint endeavors may vary in size, complexity and respective responsibilities of the parties, they are negotiated on a case-by-case basis. On one end of the spectrum, such as the demonstration of the feasibility of manufacturing capability in orbital flight, extensive negotiations of invention and data rights may be expected. As a general rule, the industry participant may retain rights to inventions and proprietary data produced in carrying out its responsibilities under the joint endeavor, subject to certain contingent rights in NASA. These contingent rights are structured to assure access to the technology in the event the private participant cannot or does not carry out its responsibilities. Additional consideration is given to public needs in the area of health, safety and welfare if applicable, as well as the status of rights in the event of termination by either party. All in all, however, rights to inventions and know-how are a matter of negotiation, consistent with NASA's announced policy of providing incentives for early participation of the private sector in commercial use of space.[6]

On the other end of the spectrum joint endeavors may merely be technology exchange agreements. In this situation NASA and the industrial participant agree to exchange know-how relating to a particular activity. Usually each party agrees to provide to the other only that information which can be used and disclosed without restriction. If, however, "protectible information" is involved, NASA may agree to receive such information in confidence and to use it only to the extent provided in the joint endeavor.

Overlaying NASA's policy regarding joint endeavors or any similar arrangements falling within the spectrum discussed above is NASA's policy to receive adequate information without restriction to comply with its responsibilities under section 203 (a) (3) of the Space Act, but to respect privately funded rights. NASA may pay particular attention to the Freedom of Information Act and court decisions regarding the protection of intellectual property rights to any data furnished to the government. Thus, in any joint endeavor or similar arrangement there usually is a positive statement as to that data which NASA will receive without restriction on its use or disclosure. Beyond that, there is clear understanding as to NASA's rights and obligations regarding any "protectible" data that may be furnished to NASA, structured in a manner to provide maximum protection to the private party. The requirement for access to this latter type of data is kept to a minimum, and if it is needed it is received in confidence and used only to the extent necessary for NASA to carry out its responsibilites under the joint endeavor, unless the contingent rights are exercised.

Implications for the Future

A review of NASA's policies, practices and procedures in the area of intellectual property rights indicates a firm policy decision to provide incentives for the private sector to become involved in innovative transactions, such as joint endeavors, for the commercial use of space. NASA has had a history, since it initially had to make reasoned judgements in implementing section 305 of the Space Act, of being extremely flexible yet realistic in protecting private interests and of keeping private incentive and initiative at a high level. The innovative approaches applied to joint endeavors for commercial use of space demonstrate a logical extension of that history. Obviously, in addition to joint endeavors of the type discussed there is a range of similar arrangements which may be entered into with the private sector for commercial use of space, consistent with the policies and objectives of the Space Act. As far as intellectual property rights are concerned, the stage has been set and the precedent well established for NASA to negotiate such rights in a manner wholly consistent with these policies and objectives.

Strong legal protection for the results of private ventures in space is essential if such ventures are to flourish. NASA has recognized this and has formulated its policies accordingly.

FOOTNOTES

[1] The relevant portions of section 305 read as follows:

"SEC. 305. (a) Whenever any invention is made in the performance of any work under contract of the Administration, and the Administrator determines that —

> (1) the person who made the invention was employed or assigned to perform research, development, or exploration work and the invention is related to the work he was employed or assigned to perform, or that it was within the scope of his employment duties, whether or not it was made during working hours, or with a contribution by the government of the use of government facilities, equipment, materials, allocated funds, information proprietary to the government, or services of government employees during working hours; or
>
> (2) the person who made the invention was not employed or assigned to perform research, development, or exploration work, but the invention is nevertheless related to the contract, or to the work or duties he was employed or assigned to perform, and was made during working hours, or with a contribution from the government of the sort referred to in clause (1),

such invention shall be the exclusive property of the United States, and if such invention is patentable a patent therefor shall be issued to the United States upon application made by the Administrator, unless the Administrator waives all or any part of the rights of the United States to such invention in conformity with the provisions of subsection (f) of this section.

"(f) Under such regulations in conformity with this subsection as the Administrator shall prescribe, he may waive all or any part of the rights of the United States under this section with respect to any invention or class of persons in the performance of any work required by any contract of the Administration if the Administrator determines that the interest of the United States will be served thereby. Any such waiver may be made upon such terms and under such conditions as the Administrator shall determine to be required for the protection of the interests of the United States. Each such waiver made with respect to any invention shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferrable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. Each proposal for any waiver under this subsection shall be referred to an Inventions and Contributions Board which shall be established by the Administrator within the Administration. Such a Board shall accord to each interested party an opportunity for hearing, and shall transmit to the Administrator its findings of fact with respect to such proposal and its recommendations for action to be taken with respect thereto.

"(j) As used in this section - -

> (1) the term "person" means any individual, partnership, corporation, association, institution, or other entity;

(2) the term "contract" means any actual or proposed contract, agreement, understanding, or other arrangement, and includes any assignment, substitution of parties, or subcontract executed or entered into thereunder; and

(3) the term "made," when used in relation to any invention means the conception of first actual reduction to practice of such invention.

[2]The 1963 Memorandum was replaced by a 1971 Presidential Memorandum which differed only in detail from the earlier memorandum. Each of these has now been superseded by a Memorandum from the President on Federal Patent Policy dated February 18, 1983. That new policy provides:

> "To the extent permitted by law, agency policy with respect to the disposition of any invention made in the performance of a Federally funded research and development contract, grant or cooperative agreement award shall be the same or substantially the same as applied to small business firms and nonprofit organizations under chapter 38 of title 35 of the United States Code."

Charpter 38 of title 35 in general creates a presumption that the contractor shall have the first right of refusal of commerical rights to an invention made under a government contract.

[3]NASA Patent Waiver Regulations, 14 CFR, section 1245, subpart 1. Section 305 (f) also requires that any waiver which is granted," shall be subject to the reservation of an irrevocable, nonexclusive, nontransferrable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States." The Presidential Memorandum and Statement also provide that agencies usually are to retain similar rights, as well as rights of essentially the same scope, for states and domestic municipal governments. In addition, the Memorandum and Statement reserve to the government certain directed licensing rights (so-called "march-in" rights) to assure commercialization of the invention, and to assure availability to meet public health, safety and government regulatory needs. These license rights and march-in rights have been adopted in the NASA waiver regulations.

[4]Section 203 (a) (3) provides that:

> "(a) The Administration, in order to carry out the purpose of this Act, shall -
>
> "(3) provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."

The Freedom of Information Act, title 5, United States Code, section 552, requires government agencies to release to any requestor agency records unless they fall under nine specific exemptions. One of those exemptions (section 552 (b) (4)) relates to trade secrets and confidential business information.

[5]The results of the second study are reprinted as Appendix G in the article "Intellectual Property Rights in Space Ventures," by the author, published in

Volume 10, Journal of Space Law, page 122 (1982).

[6] The propietary rights in inventions clauses of an early joint venture are published in full in Appendix F of the article cited in footnote 5 supra. That joint venture was between NASA and McDonnell Douglas Astronautics Company ("MDAC") and concerned materials processing in space. Relevant portions of the "Property Rights in Inventions" article read as follows:

"A. ... MDAC-St. Louis and any party in privity therewith shall retain all right, title and interest to any invention conceived or first actually reduced to practice in carrying out its responsibilities under this agreement as described in Article II of this Agreement.

"B. With respect to any invention subject to paragraph A above, the following will apply:

> 1. NASA shall have a contingent royalty-free license to practice or have practiced in a space environment only, such inventions by or on behalf of the government for any government purpose. The contingent royalty-free license is a nonexclusive paid-up license to all inventions contained in paragraph A above, and all data and patents necessary to practice or have practiced such inventions in space, which data will be furnished to NASA, and will become effective if the NASA Administrator or his/her designee determines such action is necessary, (i) because MDAC-St. Louis or any party in privity therewith has not taken, or is not expected to take within a reasonable time, effective steps to achieve commercial utilization of the invention; or (ii) in response to a national emergency involving a serious threat to the public health and upon a showing that (a) no competitive alternative to the subject matter covered by the patent is reasonably available from other sources and (b) MDAC-St. Louis or its parties in privity are not supplying the subject matter covered by the patent in sufficient quantity and at reasonable prices to satisfy market needs; or (iii) in event of a unilateral termination by MDAC-St. Louis....
>
> 2. If a determination is made by the NASA administrator or his/her designee that action is necessary as a result of (i) or (ii) in paragraph B1 above, NASA has the right to require the granting of a license to responsible parties, upon terms and conditions reasonable under the circumstances, or to so grant such a license itself, if in the judgement of the NASA Administrator or his/her designee that MDAC-St. Louis or its parties in privity have not effectively taken steps or have been unsuccessful in licensing to satisfy the requirements of (i) and (ii) above.

"C. Prior to the making of a determination by the NASA Administrator or his/her designee under paragraph B above, NASA's Associate Administrator, Office of Space and Terrestrial Applications, shall give MDAC-St. Louis sixty days' written notice of intention to make such determination and provide findings in support thereof and shall afford MDAC-St. Louis an opportunity to be heard and offer evidence in support of its position. Any determination will be subject to Article XXV, "Disputes."

"D. MDAC-St. Louis shall, at the request of NASA, provide NASA with a brief description of any invention subject to paragraph A above, and of any action taken to obtain patent protection thereon, and of the final disposition of such action. Any brief description so provided shall be subject to protection from disclosure under the provisions of paragraph C of Article VIII, "Data Rights" until a patent is issued thereon or the patent application is otherwise made available to the public."

# \# \# \#

Appendix 6

Excerpts from Treaties Governing Space Activities

This appendix sets forth selected provisions of four treaties which place responsibilities on the United States in the conduct of space activities and the utilization of outer space. These provisions are cited to provide a better understanding of United States treaty obligations which necessitate an orderly regulatory process.

Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies (October 10, 1967)

Article I

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

....

Article II

Outer space, including the moon and other celestial bodies is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

Article III

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

Article IV

States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

....

Article VI

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

Article VII

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the Earth, in air space or in outer space, including the moon and other celestial bodies.

Article IX

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the Earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other State Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

Article X

In order to promote international co-operation in the exploration and use of outer space, including the moon and other celestial bodies, in conformity with the purpose of this Treaty, the States Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States.

The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XI

In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities. On receiving the said information, the Secretary-General of the United Nations should be prepared to disseminate it immediately and effectively.

……

Convention on International Liability for Damage Caused by Space Objects

(October 9, 1973)

Article I

For the purposes of this Convention:

(a) The term "damage" means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natual or juridical, or property of international intergovernmental organizations;

(b) The term "launching" includes attempted launching;

(c) The term "launching State" means:

- (i) A State which launches or procures the launching of a space object;
- (ii) A State from whose territory or facility a space object is launched;

(d) The term "space object" includes components parts of a space object as well as its launch vehicle and parts thereof.

Article II

A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft in flight.

……

Convention on Registration of Objects Launched Into Outer Space (Sept. 15, 1976)

Article I

For the purposes of this Convention:

(a) The term "launching State" means:

(i) A State which launches or procures the launching of a space object;

(ii) A State from whose territory or facility a space object is launched;

(b) The term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof;

(c) The term "State of registry" means a launching State on whose registry a space object is carried in accordance with article II.

Article II

1. When a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching shall inform the Secretary-General of the United Nations of the establishment of such a registry.

2. Where there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object in accordance with paragraph 1 of this article,........

3. The contents of each registry and the conditions under which it is maintained shall be determined by the State of registry concerned.

Article III

1. The Secretary-General of the United Nations shall maintain a Register in which the information furnished in accordance with article IV shall be recorded.

2. There shall be full and open access to the information in this Register.

Article IV

1. Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:

(a) Name of launching State or States;

(b) An appropriate designator of the space object or its registration number;

(c) Date and territory or location of launch;

(d) Basic orbital parameters, including:

(i) Nodal period,

(ii) Inclination,

(iii) Apogee,

(iv) Perigee;

(e) General function of the space object.

2. Each State of registry may, from time to time, provide the Secretary-General of the United Nations with additional information concerning a space object carried on its registry.

3. Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit.

……………………………………………………

Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (Ratified by United States Jan. 17,1980)

Article I

1. Each State Party to this Convention undertakes not to engage in military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State Party.

2. Each State Party to this Convention undertakes not to assist, encourage or induce any State, group of States or international organization to engage in activities contrary to the provisions of paragraph 1 of this article.

Article II

As used in article I, the term "environmental modification techniques" refers to any technique for changing—through the deliberate manipulation of natural processes—the dynamics, composition or structure of the earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space.

Article III

1. The provisions of this Convention shall not hinder the use of environmental modification techniques for peaceful purposes and shall be without prejudice to the generally recognized principles and applicable rules of international law concerning such use.

2. ....

Article IV

Each State Party to this Convention undertakes to take any measures it considers necessary in accordance with its constitutional processes to prohibit and prevent any activity in violation of the provisions of the Convention anywhere under its jurisdiction or control.

……

Academy Studies Conducted for the National Aeronautics and Space Administration

The Transformation of Scientists and Engineers into Managers, July 1972

NASA Seminar on Organization and Management, August 1972

Unmanned Space Project Management: Surveyor and Lunar Orbiter, December 1972

The Administration of the NASA Space Tracking System and the NASA Space Tracking System in Australia, January 1973

Project Management in NASA : The System and the Men, January 1973

Report of the Ad Hoc Panel on NASA Management Structure, March 1973

Report of the NASA Ad Hoc Panel on Attracting New Staff and Retaining Capability During a Period of Declining Manpower Ceilings, June 1973

Developing NASA's Future Leaders: An Assessment of Needs and Recommendations for Action, June 1975

Achieving Equal Opportunity in NASA: An Assessment of Needs and Recommendations for Action, January 1976

U.S. Space Transportation in the 1980's: Organizational Alternatives, June 1977

APPENDIX B

COMMENTS BY
L. N. CORMIER, PRESIDENT, TRANSPACE, INC

ON H.R. 1011

RESPECTFULLY SUBMITTED TO THE

SUBCOMMITTEE FOR SPACE SCIENCE AND APPLICATIONS
COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

The commercialization of space launch services is proceeding rapidly. As these services become cheaper and as space becomes more accessible, the products and services that depend upon space could enter a boom period that might be likened to that brought on by the first Transcontinental Railroad.

TranSpace®, Inc. is unique among the proposed private launch services for its choice of the reusable Space Van over expendable launch vehicles. Reusability is the key to low-cost space transportation. Not only is the Space Van reusable, but it is designed to minimize development costs through its small size and through maximum use of off-the-shelf equipment and technology. The key pieces of available equipment are the 100% reliable United Technologies/Pratt & Whitney RL10 rocket engine and the Boeing 747 transport that serves as a first stage of the total system. The key piece of new technology is TranSpace's proprietary thermal protection system. The Space Van design combines these in a way that requires no other new technology and very little in the way of new subsystems. We plan to engineer and assemble the Space Van in Reno, Nevada, with appropriate help from the existing aerospace industry.

Launch facilities will be relatively simple. The Van rides piggyback on a modified 747 from which it is launched at 40,000 feet. Thus, though we plan to launch from Pago Pago, American Samoa, for safety and other reasons, we could launch from any standard air strip capable of handling heavy aircraft. This drastically reduces the investment required for launch facilites and gives the Space Van flexibility never before achieved by a launch vehicle. For economic reasons, we plan to provide a propellant production facility at Pago Pago -- rather than to transport propellants to the takeoff site.

Simple design and the 100% reliable RL10 engine -- along with the air-launch approach and the metallic exterior thermal protection system -- contribute to quick turnaround times. Flights with the same orbiter could be as little as one week apart. This, and the availability of multiple launch vehicles will provide users with previously unavailable flexibility. Experiments that now take years could be done in weeks. Results from one test could be integrated quickly and additional tests conducted to explore puzzling results -- with limited delay over normal laboratory time frames. Researchers will be in a better position to gain funding support when their projects can show tangible results without tying up company monies for years. Manufacturers will be freer to follow market trends and less tied down by the demands of a strict launch schedule. Government/military projects can be flown on a few days notice without seriously disrupting other scheduled launches.

The greatest advantage of the Space Van, however, is likely to be its potential for expanding existing space markets and for enabling entirely new markets through low-cost access to space. Our current cost goals (in 1988 dollars, assuming an average of 8%/yr inflation) are as follows:

Traffic Level to Low-Orbit Equivalent		Low Easterly Orbit		Synchronous Orbit	
		Per Flight	Per Kg	Per Flight	Per Kg
Low:	120 Tons/yr	$ 9,200,000	$3067	$36,800,000	$12,300
Medium:	500 Tons/yr	3,000,000	1000	12,000,000	4,000
High:	3000 Tons/yr	1,330,000	443	5,320,000	1,773

The sensitivity of price to traffic level is due to the need to recover venture-capital funding of development costs.

The kind of cost reductions indicated in the above table should have a strong effect on the conduct of commercial business in space. Communications satellite designers could use heavier weights in orbit: (a) to reduce the costs of ground stations, (b) to conserve and to expand the freqency spectrum, (c) to localize private communications and (d) to broadcast television and radio programs directly to relatively simple ground antennas. Such cost reductions could permit a great expansion of the economically practical items that could be manufactured in space. Disposal of high-level nuclear wastes outside of the solar system would, for the first time, becomes cost effective.

With such low launch costs all manner of new projects become possible. While TranSpace's current business plans are based upon demand for a relatively low number of flights per year, the number of dollars now spent on space transportation services would purchase two or three Space Van flights per day . With new demand created by low per kilogram costs to orbit TranSpace, Inc could be taking the first step toward starting an aerospace airline!

It is because of the high volume business we expect that we applaud the move to reduce the complexity of obtaining licenses for private launches. The ground breaker in this area, Space Services, Inc., spent a quarter of a million dollars and six months to obtain the necessary permits for a simple launch without a payload. Such entanglements for all practical purposes would strangle launch systems such as the Space Van and the unique benefits that could derive from it. We hope that as the committee studies HR 1011 it will consider making further simplifications in the proposed procedure. It is essential to the type of flexible service we envision that the proposed licensing time be drastically cut. Though 180 days is quite practical for vehicles that have long turnaround times and set schedules, the major advantages for our users will be a flexible schedule and low cost through high launch rates. Without these advantages the advancements we foresee in space experimentation and commercial use will be severely slowed, perhaps choked off altogether.

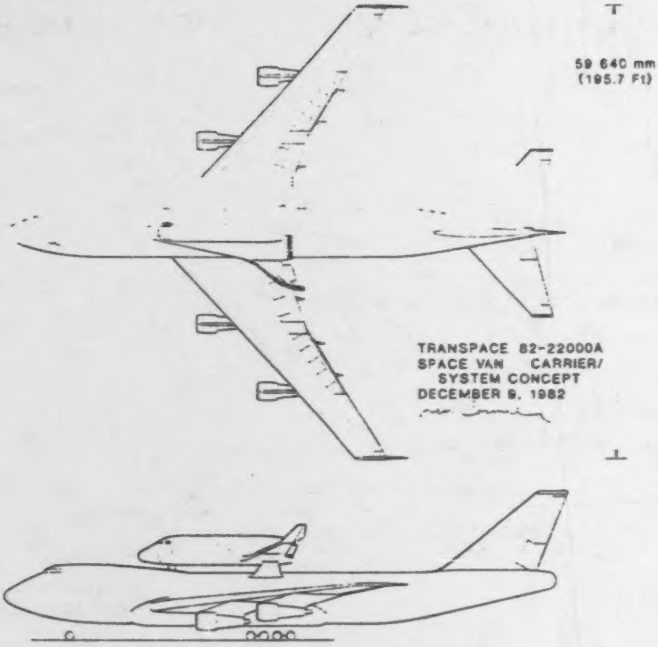
Changes that would further encourage the use of space by the private sector might include provisions for different classes of permits that allow multiple-launch approval for common payloads under standard conditions. This, for example, would facilitate licensing the transport of recurring payloads such as fuel, oxidizer, basic materials and standard equipment for orbiting satellites and platforms. A similar principle could apply to one-time approval of progressive projects such as materials processing experiments. Experimenters could submit the plan for their experiment -- outlining planned payloads and launch dates for a series of connected tests to be conducted under one simple permit. With allowances for flexibility in the schedule experimentors can meet both licensing requirements and their own needs.

With the enactment of this law the U.S will have made a giant stride toward meeting its international obligation to ensure the safety of launches by its nationals. As with any new product, however, solid standards are difficult to determine. In judging the safety of a vehicle such as the Space Van, we hope that aircraft-certification standards will not be applied arbitrarily -- just due to the fact that the Space Van, relative to expendable launch vehicles and even the Space Shuttle, more closely resembles an aircraft. TranSpace feels that a vehicle such as the Space Van is potentially safer than expendable launch vehicles. However, arbitrary application of aircraft-certifcation standards to the Space Van could result in penalties that would eliminate payload. When compared to the Space Shuttle, the Space Van has a number of inherent abort and safety advantages. However, the extremely rigid NASA requirements for man-rating — if applied to the Space Van — would likely result in conformance expenses that would preclude TranSpace's low-cost goals. Accordingly, TranSpace requests that cargo-only flights flown by a company pilot be considered as a category separate from flights that would carry passengers for hire. However, please note that several years ago TranSpace -- pursuant to Securities and Exchange Rule 240 -- sold four prepaid passenger trips to low orbit in order to raise seed capital and to strengthen its trademark position. Moreover, TranSpace hopes eventually to be able to carry passengers for hire, once the safety and reliability of the Space Van is well proven.

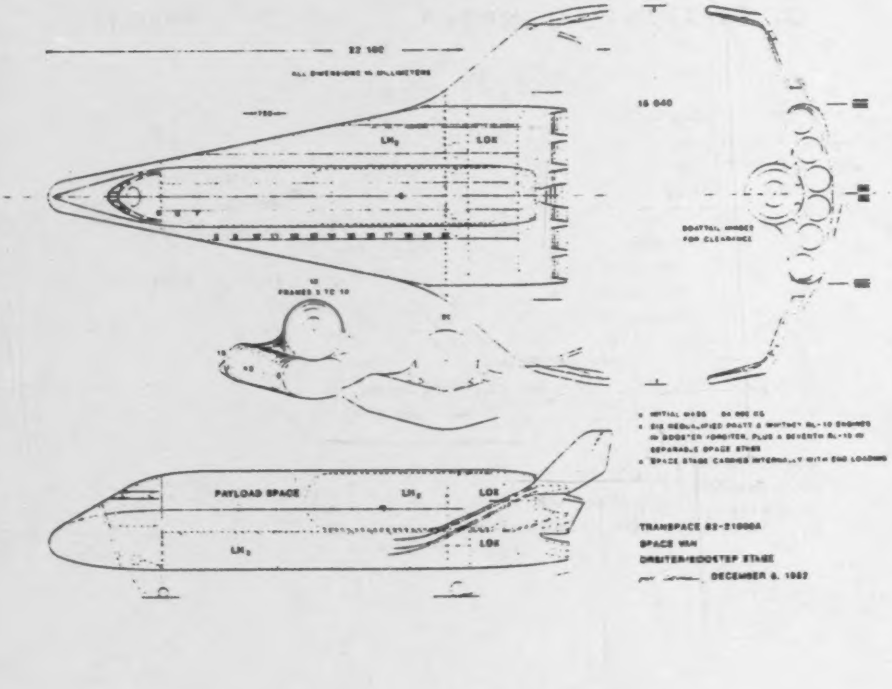
Finally, TranSpace hopes that the spirit of cooperation and encouragement that NASA and Congress has shown thus far will be part of the enactment and, especially, the execution of this proposed law. The broad powers to be given to the Secretary of Commerce are as capable of crippling this budding industry as they are of enabling it to grow. With due regard to essential safety and liability requirements -- the determining of where the line falls between helping and hampering regulations must be done with care and unusual foresight. As an essentially new industry, private sector launch services offer an opportunity to integrate strong industry-government cooperation from the outset. This would enable U.S. companies to counter growing international competiton more effectively and strengthen the industry as a whole to meet domestic private/governmental needs. The Commercial Space Study Commission established by this bill can be a major step toward meeting both these goals. TranSpace offers whatever services it can to the Commission to aid it in the fulfillment of its directive.

The need for HR 1011 is evident. Private launch services are gearing up to be ready to vie for the world's payloads. Legislation clearing the way will enable U.S. companies to compete more effectively and will boost space related industries that benefit from the reduced transportation costs and improved service that stiff competition brings.

Attachment: Figures illustrating the current Space Van configuration and operational concept.


59 640 mm
(195.7 Ft)

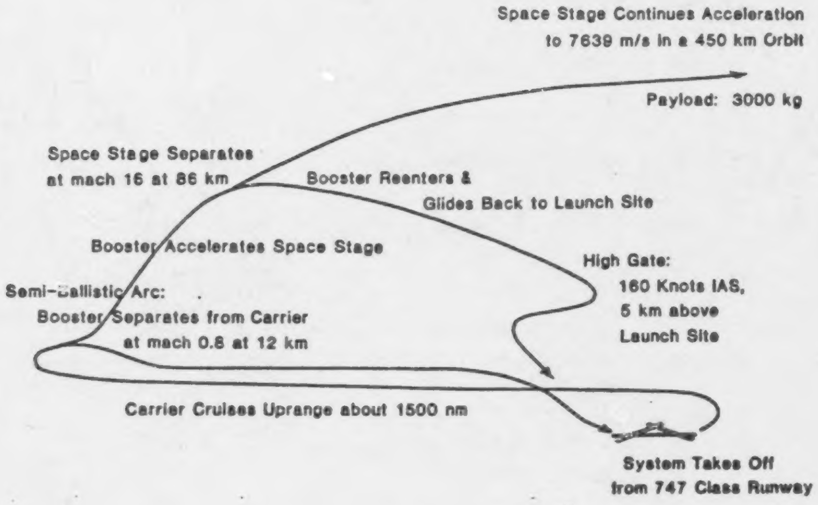
TRANSPACE 82-22000A
SPACE VAN CARRIER/
SYSTEM CONCEPT
DECEMBER 9, 1982


22 100
ALL DIMENSIONS IN MILLIMETERS
750
LH2
LOX
16 040
BOATTAIL HINGED
FOR CLEARANCE
10
FRAMES 5 TO 10
PAYLOAD SPACE
LH2
LOX
LH2
LOX

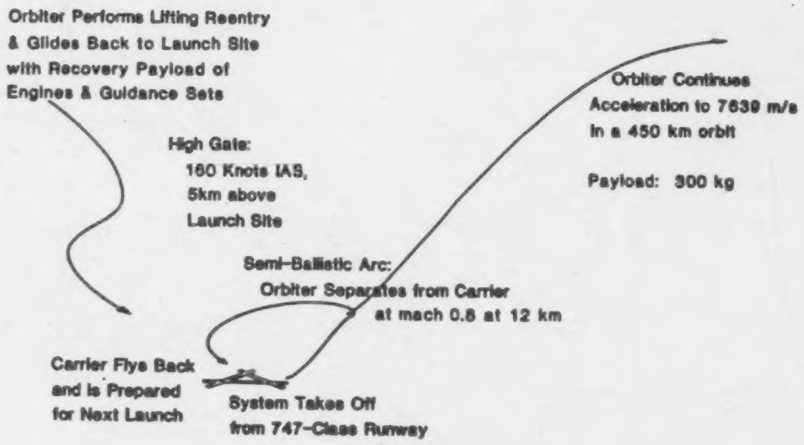
- INITIAL MASS 94 000 KG
- SIX REQUALIFIED PRATT & WHITNEY RL-10 ENGINES IN BOOSTER/ORBITER, PLUS A SEVENTH RL-10 IN SEPARABLE SPACE STAGE
- SPACE STAGE CARRIED INTERNALLY WITH END LOADING

TRANSPACE 82-21000A
SPACE VAN
ORBITER/BOOSTER STAGE
DECEMBER 9, 1982

OPERATIONAL CONCEPT --BOOSTER MODE


Space Stage Continues Acceleration to 7639 m/s in a 450 km Orbit
Payload: 3000 kg
Space Stage Separates at mach 16 at 86 km
Booster Reenters & Glides Back to Launch Site
Booster Accelerates Space Stage
High Gate: 160 Knots IAS, 5 km above Launch Site
Semi-Ballistic Arc: Booster Separates from Carrier at mach 0.8 at 12 km
Carrier Cruises Uprange about 1500 nm
System Takes Off from 747 Class Runway

OPERATIONAL CONCEPT -- ORBITER MODE


Orbiter Performs Lifting Reentry & Glides Back to Launch Site with Recovery Payload of Engines & Guidance Sets
Orbiter Continues Acceleration to 7639 m/s in a 450 km orbit
Payload: 300 kg
High Gate: 160 Knots IAS, 5km above Launch Site
Semi-Ballistic Arc: Orbiter Separates from Carrier at mach 0.8 at 12 km
Carrier Flys Back and Is Prepared for Next Launch
System Takes Off from 747-Class Runway

APPENDIX C

Legal Aspects of Commercial Space Activities

Martin Menter
Haffer & Alterman
Washington, D. C.

Presented at National Institute,
American Bar Association program
"Aviation Litigation & Space Law"
Sheraton-Washington Hotel,
Washington, D.C., May 29, 1982

I. INTRODUCTION

The successful flights of the U.S. Space Shuttle presages increased opportunity for private sector activities in space. Past NASA activities, with private sector participation, has resulted in new developed processes and products, new companies and the employment of thousands of additional persons. We are all familiar with the many new benefits to the home and business community, including medicines and medical procedures and technological advances in the computer industry.

The private sector also already has participated in commercial activities in space communication satellites owned by COMSAT, Western Union and by RCA that are bringing to the public ever growing innovative benefits in video and voice communication. Programs such as ours today have been transmitted to selected outlets throughout the country. On January 29th of this year, the National Satellite Network (NSN) of the Public Service Satellite Consortium (PSSC) transmitted a seminar by satellite for the ALI-ABA Committee on Continuing Legal Education. It was a six hour program transmitted via Western Unions Westar-1 from Station WHYY, Philadelphia, to 50 receiver sites nationwide, including public television stations, a hotel equipped with a receive-only earth station and the PSSC Denver technical office. It was the fifth in a series of ten such programs that PSSC is transmitting in 1982 for ALI-ABA (PSSC Newsletter March, 1982). Corporations having constitutent local offices throughout the country are able to hold teleconferences in which two-way video and audio is had with the participants. This, obviously, saves costs of travel, hotels, and time lost over having the conference in one hotel and city.

Today, our satellites are comparatively small in size requiring rather large ground receivers. With the Space Shuttle, larger satellites will be unfolded in space that will permit great reduction in the size of the receivers. Arthur A. Woods, Jr., a Lockheed Sunnyvale, California antenna expert, is reported as predicting a two-way wrist radio as a reality by the year 2000; a small, low power radio using a simple antenna could transmit voice to anywhere in the continental U.S. (Insight, Sept.-Oct. 1981, a publication of the National Space Institute, at p.10). Of all activities in outer space, communication is and will continue for the near future the most advanced in terms of commercial return on investment.

from space. However, the issue became academic upon the enactment by Congress of the Communication SAtellite Act of 1962 as this Act gave birth to COMSAT - a private corporation "created ...for profit." The corporation was authorized to create, and operate either by itself or in conjuction with foreign governments or business entites " a commercial communication system" (47 U.S.C. sec 731, 735). On December 13, 1962, the UN General Assembly by Resolution (UN Res 1962/XVIII) entitled "Declaration of Legal Principles Governing Activites of States in the Exploration and Use of Outer Space" expressly recognized that a nation's national activities in space could be carried on by its "non-governmental entites" as well as by governmental agencies. However, all non-governmental entities activities in space required "authorization and continuing supervision by the State concerned". Similar wording was included in Article VI of the initial space Treaty, the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and other Celestial Bodies," which became effective on October 10, 1967 (18 UST 2410, TIAS 6347, 610 UNTS 205). This Treaty is hereinafter referred to as the "OST."

The requirement of government authorization and continuing supervision to my mind does not mean that a government representative is to be ever present with the commercial space activity. Rather, the responsible Government agency or agencies would issue appropriate directives within statutory guidelines. By consultations, reports, inspections and investigation of reported discrepancies, compliance should be assured. To a great degree, the supervision would be similar to regulatory control exercised today over licensed private sector activities.

B. Planning

1. Presidential Directives

On June 10, 1978, President Carter established a Space Policy Review Committee within the Executive Office of the President under the Chairmanship of the Director of Science and Technology, with the assigned objective, among others, of:

> ". . . the encouragement of domestic commercial exploitation of space capabilities and systems for economic benefit and to promote the technological position of the United States."

remote sensing of Earth resources. He related that Landsat D is scheduled for launch in July of this year; that NOAA will assume reponsibility for operating the spacecraft and producing Landsat tapes and images as soon as acceptable performance criteria are met for Landsat D, expected to be by January 31, 1983. The spacecraft will carry the new higher resolution Thematic Mapper (TM) sensor, which is experimental, in addition to the Multispectral Scanner (MSS), which is an operational sensor. NASA will retain responsibility over the TM for a two-year R & D effort; thereafter, in about January, 1985, NOAA will assume responsibility for management of the TM activity. Dr. Calio noted that with NOAA's takeover of Landsat operations, the U.S. will have for the first time a single manager of the Landsat program--from spacecraft command and control to data production and dissemination. NOAA will have on-site managers at the distribution Data Center at Sioux Falls, S.D.. It will become a NOAA rather than a Department of the Interior activity. NOAA has also issued a Request for Proposal for a contractor for management of its ground spacecraft command and control and data processing functions at the NASA Goddard Space Flight Center in Greenbelt, Maryland. A new increased price list for Landsat products will become effective October 1, 1982.

The Landsat D, with its higher resolution TM, Dr. Calio noted

> "...will improve the ability to locate minerals, oil and gas and other non-renewable resources; to monitor and forecast global crop production; to manage its renewable resources; and to monitor major floods, earthquakes and other natural disasters."

He also noted that NOAA, in planning for operational takeover and commercialization of Landsat, is creating a 15-member non-Federal Land Remote Sensing Advisory Committee which may have had its first meeting by the date of this ABA National Institute program.

Prior to seeking this explicit legislative authority for NOAA's establishment of an operational space based land remote sensing satellite system, the Department of Commerce had authority to operate certain environmental and meteorological satellites. It is interesting to note that the President's Cabinet Council on Commerce and Trade Policy Review is currently considering two questions here related, viz:

NASA research: (1) providing flight time on the space transportation system on appropriate terms and conditions as determined by the Administrator; (2) providing technical advice, consultation, data, equipment and facilities to participating organizations; and (3) entering into joint research and demonstration programs where each party funds its own participation.

In making the necessary determination to proceed under this policy, the Administrator will consider the need for NASA funded support to commercial endeavors and the relative benefits to be obtained from such endeavors.

As major areas for NASA enhancement of total U.S. capability, including the private sector, may become apparent from time to time, the factors to be considered by NASA prior to providing incentives may include, but not be limited to, some or all of the following considerations: (1) the public or social need for the expected technology development; (2) the contribution to be made to the maintenance of U.S. technological superiority; (3) possible benefits accruing to the public or the U.S. Government from sharing in results; (4) the enhanced economic exploitation of NASA capabilities such as the space transportation system; (5) the desirability of private sector involvement in NASA programs; (6) the merit of the research, development or application proposed; (7) the degree of risk and financial participation by the commercial concern; (8) the amount of proprietary data or background information to be furnished by the concern; (9) the rights in data to be granted the concern in consideration of its contribution; (10) the ability of the concern to project a potential market; (11) the willingness and ability of the concern to market and sell any resulting new or enhanced products on a reasonable basis; (12) the impact of NASA sponsorship on a given industry; (13) provision for a form of exclusivity in special cases when needed to promote innovation; (14) recoupment of the NASA contribution under appropriate circumstances;

obtain adequate insurance, NASA may provide the user insurance and/or indemnification for a reasonable fee to be agreed upon by the user and NASA (Id., par. 2e). Authority for such NASA actions was granted by the National Aeronautics and Space Administration Act, 1980, which added a new Section 308 to the National Aeronautics and Space Act of 1958 providing for insurance and indemnification from third party liability for users of the Space Shuttle or other NASA vehicles under regulations to be prescribed by the NASA Administrator (Pub. L. 96-48, 93 Stat. 348, Sec. 6). A Notice of Proposed Rulemaking (NPRM) setting forth detailed implementing regulations of the NASA Administrator has been published (14 C.F.R. 1214; Fed. Reg., Vol. 45, No. 219, Nov. 10, 1980, pp. 74499-74502). The third party liability risk provisions pertaining to Space Shuttle launch agreements recited above are contained in the proposed regulations. (Id., App. A, p. 74501). A notice of final rulemaking is momentarily expected. The final rule will exempt from the requirement to obtain insurance all users flying small self-contained payloads and users who provide payload specialists services for NASA missions under a NASA contract. Except to the extent that a NASA waiver may be granted in the public interest, all other users are required to obtain the insurance. The amount, terms and conditions of the insurance are to be agreed upon between the user and NASA, with NASA agreeing to indemnify each user (except other U.S. Government agencies) for third party liability incurred by the user in excess of purchased NASA approved insurance. (Id., Sec. 1214.1302, p. 74500).

(2) Patent Rights

Section 305 of the National Aeronautics and Space Act of 1958, as amended (42 U.S.C. Sec. 2457) sets out several provisions concerning NASA's and others' property rights in inventions. The NASA Administrator is vested with authority, under regulations he may prescribe, to waive all or part of rights of the U.S. under Section 305 with respect to inventions made in the performance of contracts with NASA where the Administrator determines that the interests of the United States will be served thereby. However, each such waiver must be subject to a reservation by the Administrator of an irrevocable, nonexclusive nontransferable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States (Id. subsec. (f)).

agreement was entered into on January 20, 1982 between NASA and GTI corporation (of San Diego) to

> "Jointly and diligently pursue an endeavor to develop and demonstrate the technology of furnace flight and materials development in the low-gravity environment of space, and to ascertain the applicability of this technology to the processing of alloy samples in space" (thereinafter referred to as Materials Processing).

The "furnace system" was therein defined as

> "a computer controlled, multi-cavity modular furnace including all system unique ground and flight software and support equipment capable of processing large numbers of alloy samples under low gravity conditions."

As both the McDonnell and GTI agreements, as here concerned, contain similar recitals, the following will pertain to the more recent GTI agreement, except where specific reference is made to the McDonnell agreement.

The forthcoming fourth and final test flight of the Space Shuttle is scheduled for this July. It will check-out the equipment for the McDonnell space experiments. Thereafter, the experiments will be conducted on eight flights with completion in 1986. Any flights thereafter on the Shuttle will be at regular NASA contract charges. GTI's initial shuttle flight will be in January 1985. Selected provisions of the GTI agreement have been extracted and are herein set out:

"ARTICLE II

APPROACH

****

> Section 2.02. Three Phase Approach. This Joint Endeavor shall be executed in three phases, each phase proceeding, where possible, after the completion of the previous phase.
>
> (a) Phase 1: Project Definition, Furnace System Preliminary Design and Preliminary STS Accomodations Assessments.

ARTICLE III

GTI RESPONSIBILITIES

Section 3.01. Development of Space Flight Multichamber Furnace Technology. In accordance with the spirit of NASA's MPS commercialization program, GTI shall apply its commercially reasonable best efforts to develop spaceflight multichamber furnace technology, and shall investigate the resolidification of materials and alloys under low gravity conditions, using materials of interest to its customer base. Also, using information and data from its customer base, GTI shall develop processes and methods for analysis for Alloy Samples processed in low-g. GTI will also develop pricing criteria and policies relevant to the commercial marketing of Alloy Samples produced under this Joint Endeavor with NASA.

ARTICLE V

CONSIDERATION AND RIGHTS

Section 5.01. Preamble. In discharging its responsibilites in accordance with ARTICLE IV hereof, NASA's primary interests are in stimulating and accelerating technological innovation based on the processing of materials in space, and in assuring that the technology finds general use in the U.S. at the earliest practical time. In discharging its responsibilities in accordance with ~~ARTICLE III hereof, GTI is responsibilities in accordance with~~ ARTICLE III hereof, GTI is concerned with making a fair return on its investment, considering the high and long-term technological and economic risks it has undertaken by execution and delivery of this Agreement. Subject to the data and property rights protected in ARTICLES IX AND XII hereof, GTI will make available to NASA for use under this endeavor valuable intellectual property in the form of proprietary data and patent rights as well as skills related to the furnace technology to be employed.

Section 5.02. Commercial Sales. It is the intent of both GTI and NASA that any promising results arising from this Joint Endeavor will result in commercial sales.

(a) NASA shall have a contingent royalty free license to practice or have practiced for Governmental purposes such inventions contained in Section 12.01 above, and all data and patents necessary to practice or have practiced such inventions, which data will be furnished to NASA, and will become effective if the NASA Administrator or his/her designee determines such action is necessary, (i) because GTI has not taken, or is not expected to take within a reasonble time, effective steps to achieve commercial utilization of the invention; or (ii) in the event of a unilateral termination by GTI in accordance with ARTICLE XXVIII, Section 28.02(b)(ii)(1).

(b) If a determination is made by the NASA Administrator or his/her designee that action is necessary as a result of (i) in Section 12.02(a), above, NASA has the right to require the granting of a license to responsible parties, upon terms and conditions reasonable under the circumstances, or to so grant such a license itself, if in the judgment of the NASA Administrator or his/her designee that GTI has not effectively taken steps or has been unsuccessful in licensing to satisfy the requirements of said (i) above.

* * * * * * *

Section 12.04. Description of Inventions. GTI shall, at the request of NASA, provide NASA with a brief description of any invention subject to Section 12.01, above, and of any action taken to obtain patent protection thereon, and of the final disposition of such action. Any brief description so provided shall be subject to protection from disclosure under the provisions of Section 9.02 of ARTICLE IX "DATA RIGHTS" until a patent is issued thereon or the patent application is otherwise made available to the public.

ARTICLE XVI

AUTHORIZATION AND CONSENT AND PATENT INDEMNITY

Section 16.01. Indemnification. NASA hereby gives its authorization and consent to GTI and any party in privity therewith for all use and manufacture of required in an amount in excess of 500 million dollars (U.S.) nor shall the premium for such insurance be unreasonable. Notwithstanding such agreement by NASA, GTI shall have the responsibility to meet the requirements in Subparagraph (a) above. Although NASA may agree to an insurance policy, such agreement shall not result in GTI being relieved of its obligation to protect the United States Government and, to the extent the United States Government is liable to reimburse them for costs they incur for Liability, the United States Government's contractors and subcontractors by an enforceable insurance policy without exclusions or other limitations which reduce or eliminate the protection of the United States Government and such contractors and subcontractors. For purposes of determining the reasonableness of the amount of insurance and the premium cost, GTI shall obtain and deliver to NASA, at least six months prior to the first scheduled launch of the Shuttle with GTI's Payload, a quote or quotes reasonably required by NASA for such insurance from a responsible insurance agent or carrier. If GTI is unable to obtain such insurance quote or quotes, or if such quotes are not at reasonable premium cost as mutually agreed by NASA and GTI, then NASA shall provide GTI insurance and/or indemnification for reasonable consideration to be agreed upon by GTI and NASA.

* * * * * * * * *

(f) Under Section 308 of the National Aeronautics and Space Act of 1958, as amended by P.L. 96-48, NASA hereby agrees to indemnify GTI at no additional consideration for liability of the character described in Section 23.02(a) above incurred by GTI, but only to the extent that such liability is in excess of the maximum dollar limitation on insurance coverage stated in the insurance policy purchased by or provided to GTI.

* * * * * * * * *

Section 23.03. Damage to Persons or Property Involved in STS Operations.

(a) In carrying out this Agreement, GTI and NASA will bring to a United States Government envisions a significant impact on the electronic and computer industries. Here too, it is believed from prior NASA experiments in space that the low gravity there present will permit improved properties in the crystals. It is noted that in all NASA pre-Shuttle space experiments, only about ten hours total time for materials processing had been at zero gravity. Resultant know-how is to be patented by the industry participants in these joint endeavor agreements. Participants such as GTI and Microgrativy Research Associates should enjoy great profit potential in subsequent licensing employment of their discovered patented processes and sale of products, some custom made to meet the research needs of particular industries and universities. From these material processing endeavors should come beneficial giant strides in medical science and in industry, extention of human life on earth and stepping stones to expansion of man's presence in space.

In an undated document prepared for and published by NASA, the McDonnell Douglas Astronautics Company in speaking of the evolutionary growth of manned orbital facilities (MOF) in space, at page 4, stated:

> It is expected that as the payloads are operated in orbit, their products--whether scientific data or materials fashioned in space--will lead to requirements for further missions and flights. Because of the modular nature of the MOF concept, eight to twelve man facilities could follow earlier four man-missions as 1990 is approached. As an example, it could be speculated that after an initial five years of prototype and pilot-plant operation, a space-manufacturing activity on a commercial scale would be warranted. These industrial-class operations would, in turn, call for much larger work forces and more MOF units."

A chart followed depicting MOF evolutionary growth in space illustrated an initial MOF in 1985, a large structure assembly in 1989, a synchronous orbit MOF in 1993, a large station in 1995-1996, a space manufacturing facility in 1997 and "space bases" in later years (DATA Item DPD 433, DR MA-054A (MDC G5957), under McDonnell/NASA (Contract NAS8-31044, at p.4).

D. Jurisdiction

1. General

Each party to the OST retains "jurisdiction and control" over space objects on its registry and over personnel thereof while in outer space or on a celestial body (Art. VIII). However, the later Convention on Registration of Objects Launched into Outer Space provides that in a joint launch, the launching nations shall determine which of them shall register the object and thus have the jurisdiction and control (28 U.S.T. 695, TIAS 8480, effective September 15, 1976, Art. II (2)).

2. Criminal

In the National Aeronautics and Space Administration Act, 1982, the Congress extended its jurisdiction over crimes aboard spacecraft similar to what it had previously provided for crimes aboard aircraft of U.S. registry in flights over the high seas (Pub.L.97-96, Act of Dec.21, 1981, Sec. 6; 95 Stat. 1210). Section 6 of the Act extended the "special maritime and territorial jurisdiction of the United States", as such term is used in the U.S. Criminal Code, to include "any vehicle used or designed for flight or navigation in space and on the registry of the United States" pursuant to the OST and the Registration Convention "while the vehicle is in flight". "In flight" is recited to be

> "from the moment when all external doors are closed on Earth following embarkation until the moment when one such door is opened on Earth for disembarkation or in the case of a forced landing, until the competent authorities take over the responsibilty for the vehicle and for persons and property aboard."

This enactment would expressly vest U.S. criminal jurisdiction over such criminal acts as murder and over lesser assaults committed on a U.S. registered spacecraft, but without prejudice to jurisdiction otherwise agreed to in the case of a joint launch by two or more States.

The current 97th Congress, as many Congresses before it, seeks a revision of the entire U.S. Criminal Code, which revision would include an extention of jurisdiction over space flight. The current proposal in the Senate is S.1630, recompense for wrongs suffered. "Building" and other codes for the protection of personnel in future space communities may be required. As U.S. would have jurisdiction over its space station, and personnel thereon, it could provide the governing rules, preferably tailored to the station and its personnel and activities. An interim approach might be the precedent whereby Congress provided that all legislative, executive and judicial authority necessary for the civil administration of the Trust Territories of the Pacific Islands was to be vested in such person selected by the President, until Congress provided otherwise for its government (48 U.S.C. Sec. 1681(a).) It should be noted that the United States had jurisdiction but not sovereignty over such territory, similar to the conditions as would exist in outer space under the OST. Professors DeSaussure and Haanappel have warned of the difficulty of formulating governing concepts. After reviewing several criteria for the determination of the applicable law and forum concluded:

> Given the embryonic development of space law, no choice of law or forum rule can be tailored to accomodate all interests. Yet some start must be made so that the utter chaos one finds in the conflicts of law on a transnational scale on earth is at least mitigated in outer space." ("A Unified Multinational Approach to the Application of Tort and Contract Principles to Outer Space," Syracuse J. of Int'l. Law and Commerce, Vol.6, No.3(1978), pp. 1-15, at 14).

Hopefully, the expertise that is within TIPS will bring suggested solutions over the next few years to this long term problem.

III. STATUS OF PRIVATE SECTOR SPACE ACTIVITIES

A. Compliance with U.S. Treaty Obligations

1. International Cooperation

From Mrs. Eilene Galloway's excellent presentation on the development of Space Law, it is clear that the tenor of the 1967 OST and the subsequent treaties to govern space activities look to international cooperation and understanding rather than national rivalry for exploring and using outer space and its celestial bodies. To such end, outer space and its celestial bodies are declared to be the province of all mankind to be free from claims of sovereignty

2. Personnel

Personnel of a commercial concern who are aboard an object in outer space are to be accorded the benefits of "Rescue and Return of Astronauts Agreement" (Id.) where owing to accident, distress, emergency or unintended landing, they are found in territory of another nation party to the Agreement, or on the high seas or in any place not under the jurisdiction of any nation; all possible steps shall be taken for their rescue and safe return to representatives of their "launching" country. The Agreement does not use the term "Astronaut" that appears in its title, but in its text speaks of rescue of "personnel of a spacecraft." The later so-called "Moon Treaty" expressly recites that all persons on the moon are to be considered "Astronauts" within the phrase "personnel of a spacecraft" of the Rescue and Return of Astronauts Agreement and as used in Article V of the OST. The application of the law of the nation having jurisdiction over private sector personnel has previously been herein discussed.

C. Activities

1. General

There is much law applicable to the myriad of foreseeable commercial activities, be it Space law or otherwise, that need not be cited to this audience. We have previously mentioned the law and NASA's policies as to private sector's patent, data and proprietary rights in participating as a user or in a joint endeavor agreement with NASA in space experiments. Perhaps of general interest is an article as to copyright protection of satellite transmissions of public and closed circuit broadcasts and their retransmission to and through cable systems, and as to non-infringement of receipt of such broadcasts direct from the satellite by home receivers without going through a ground receiver, see E. Gabriel Perle's article "Is the Bird Pie in the Sky? - Communication Satellites and the Law," Bulletin, Copyright Society of the U.S.A. (vol. 27, June 1980, pp. 325-339, at pp. 332-333).

Aerospace technology has developed into a major segment of American industry. It has had and continues to have a major role in Government space activities. Government policy is to transfer to the private sector space programs that have been proven successful by Government undertaking and have operational commercial potential, such as the plans for formed U.S. company, the Earth Space Transport Systems Corp. (One World Trade Center, New York, N.Y. (suite 2147)), has the long range objective of a position of leadership and profitability in a passenger and freight commercial space transportation market utilizing the Shuttle and later advanced aerospace craft. (See paper of Wm. A. Good, "Space Transportation in the Private Sector" presented at the AAS's 19th Goddard Memorial Symposium, Pentagon City, Va., March 26-27, 1981; paper AAS-81-055).

2. FAA Responsibilities Over Private Sector ~~[illegible]~~ Space Flight

Both the NASA and the Federal Aviation Administration (FAA) basic legislative charters are 1958 enactments, with the FAA's following the NASA enactment by about a month. Congress, hence, must be presumed aware of the authority granted NASA when it spelled out the additional authority and responsibility of the FAA. The Federal Aviation Act of 1958, adopted the definition of "aircraft" that had been in its predecessor Civil Aeronautics Act of 1938, viz: "Any contrivance now known or hereafter invented, used, or designed for navigation of or flight in the air". Before accepting such 1938 definition, the Senate Committee on Interstate and Foreign Commerce desired to assure that airspace protection was given to "other vehicles such as rockets, missiles and other airborne objects." The Committee reported

> "After due deliberation, the committee concluded that no change in the definition of the term 'aircraft' was necessary in order to achieve this objective, since all vehicles, rockets, and missiles, as well as aircraft, are in fact used at least in part for navigation of the airspace." (S.Rep.1811,85th Cong.,P.20)

While it may be that the Senate Committee was focusing only on the FAA Administrator's airspace protection responsibility, no limitations are recited in the Act on the definition of the term "aircraft." As "aircraft" is defined in the Act as including any contrivance known or thereafter invented, used or designed for flight in the air, and construed to include rockets, missiles and launch "vehicles," then the term includes such missiles and space vehicles wherever it is recited in the FAA Act "unless the context otherwise requires" (opening recital to Sec. 101, "Definitions").

> FAA by the owner for the purpose of identification and to establish 'nationality.'.....For the purpose of its operation in airspace, the privately owned vehicle and its crew will be subject to certification requirements established by the Agency. Such certification of crews normally embraces their qualification for specific crew positions. Certification of aircraft usually contemplates the issuance of 'airworthiness' certificates for the aircraft and type and production certificates to the manufacturer of the craft."

Thus it is seen that under current law, of FAA (now through delegated authority of the Secretary of Transportation) is the regulatory agency of the U.S. Government over privately owned launch facilities and space vehicles operation. This would include certification requirements of crew and vehicle and the issuance of appropriate type certificates.

While the above conclusion is premised on a strict construction of the wording of the Federal Aviation Act of 1958, I recognize and encourage review as to whether policywise such vesting of authority in the FAA Administrator is the regulatory structure desired in light of present and forseeable private sector space activities. This should be a review by both the Executive and Legislative branches of Government with the view of draft legislation reciting vesting of authority where determined as most appropriate and desirable. Even if presently vested responsibility over private sector space vehicles is continued, a fresh legislative brush would sharpen the parameters of the FAA Administrator's authority. In an article "The Developing Law for Outer Space", appearing in the August 1967 American Bar Association Journal that I wrote when I was privileged to serve as Chairman of the ABA Standing Committee on Aeronautical Law and simultaneously as Chairman of the ABA International Law Section's Committee on the Law of Outer Space (now its "Aerospace Law Committee"), I stated:

> "As we progress in space development to the stage of private -- as distinguished from public -- ownership of launch vehicles and other spacecraft, the presentstatutory responsibilities of the Federal Government, in addition to airspace protection, should extend to such vehicles.....We should undertake now to recite more clearly the existing legislation we wish to apply and to make further amendments as may be necessary....." (pp.703-707. at p. 706)

that desired standards and recommended practices can be obtained short of requiring continuous supplementary international agreements subject to the more prolonged ratification processes of member countries.

3. Exploitation of Resources of Celestial Bodies

On December 14, 1979, the United Nations General Assembly requested the Secretary-General of the UN to open for signature and ratification the so called "Moon Agreement" (Agreement Governing the Activities of States on the Moon and Other Celestial Bodies) which had been drafted and adopted by consensus within the COPUOS. For an extensive discussion of the negotiated history of the Moon Agreement, and support for its adoption by the United States, a reading may be desired of my article "Commercial Space Activities under the Moon Treaty," published in the Syracuse Journal of International Law and Commerce (Vol.7, Number 2, Winter 1979-80, pp. 213-238).

Using language patterned after the OST, the Moon Treaty expressly recognizes private sector engagement in activities on the moon. Ambiguities in the text, however, has caused some apprehension that exploitation of the natural resources of the moon could not be undertaken until an international regime were established to govern such exploitation; and further, that benefits derived from such exploitation under the "common heritage of mankind" principle were to be shared with countries that had not invested risk capital in the endeavor.

Resort to the negotiated history is permitted under customary international law as well as Articles 31 and 32 of the recent Vienna Convention on the Law of Treaties (U.N. Doc A/CONF. 39/37 reprinted in 8 Int'l Legal Mat'ls 679 (1969) entered into force January 27, 1980; however, it has not yet been ratified by the U.S.), to ascertain the intent of the drafters. Perusal of such history establishes that no deferment of exploitation was contemplated; that the "common heritage" concept was to be limited to its use in the Moon Treaty only and not as such phrase may be elsewhere employed -- with no yet internationally formulated definition; that ownership would obtain over resources that were taken from the moon; and that the international regime was to be the subject of a separate treaty to be later drafted to which no present commitment is made. Further, the term "equitable sharing" is without definition and thus does not preclude a U.S. determination as to the sharing requirements in its exploitation of the moon's natural resources.

> "(a) It is the position of the United States that no provision of this Agreement constrains the existing right of governmental or authorized non-governmental entities to explore and use the resources of the Moon or other celestial bodies, including the right to develop and use these resources for commercial or other purposes, and no such constraint is accepted by this ratification.
>
> (b) It is the position of the United States that nothing in this agreement in any way diminishes or alters the existing right of the United States to determine unilaterally how it shares the benefits derived from development and use by or under the authority of the United States of natural resources of the Moon or other celestial bodies;" (ABA House of Delegates Report #119)

It would appear to me that extention of the rule of law to outer space must include international agreements towards greater cooperation and reduction of friction and possible causes of conflict among nations. All nations must be provided the opportunity to share in man's ascension to this new environment. The Moon Treaty is but another step toward such end while opening the door to exploitation of celestial body resources. I hope the private sector may yet concur in the U.S. becoming a party to the Moon Treaty and provide guidance to the Government as to recitals for the subsequent agreement on the international regime (whether a set of rules or an institutional arrangement), procedures and implementing measures to govern exploitation of the natural resources of the Moon and other celestial bodies. As many years will lapse before such exploitation can be determined as commercially feasible, experience gained should assist in formulation of the U.S. position for the subsequent follow-on treaty.

D. Government-Industry Cooperation

In the growth of the nation, our Government has provided incentives to the private sector to undertake new ventures -- as in land grants to the railroads in the nation's westward expansion, subsidies to air carriers to develop air transportation and tax deductions for petroleum exploration. To induce the private sector in space exploration and use, NASA has welcomed its participation in past space experiments, the Government having already borne the R & D expense of development of the launch vehicle transportation systems. To induce private sector use of the Space Shuttle,

APPENDIX D

Regulation of Private Enterprise Satellite Launchings -

Dr. Bruce Friedman, Chairman, District Five Energy Committee of B'nai B'rith

The economic utilization of the extra-terrestrial environment requires a ready access to low earth orbit (LEO) from the surface of the earth. There are a number of means by which such access can be attained. All of these means are dependent upon the use of reaction motors of one kind or another. In actual practice, all of the vehicles used to date, whether or not they be manned or unmanned, have been propelled by chemical propellant rocket engines. All of the boosters launched to date have the common feature that they have been launched by governmental entities. In the United States of America, this entity is the National Aeronautics and Space Administration (NASA). The European and Asian countries that launch artificial satellites have done so through their counterparts to NASA.

In America, until recently it was thought natural that the boosting of vehicles into the extra-terrestrial environment should be a monopoly of the federal government. There are major costs involved in the launching of a booster vehicle even before it gets to the launch pad.(1) Research and development expenses can run into the many millions of dollars and billions of dollars in expenses are not unusual for this phase. The factories must then be set up in order to do the manufacture and fabrication of operational models after they have turned out the initial test items. Very often so few operational boosters are produced that economies that could be achieved by true mass production techniques are not attainable. Launch facilities must be built or existing facilities must be modified so as to accommodate the new booster vehicles. Personnel must be recruited to prepare the launch vehicle and to maintain the launch facilities. The economics of the booster vehicle situation have been such that only the federal government has had the resources to engage in the launching of vehicles beyond the earth. It is true that a number of major private companies could have combined in a consortium which would compete with the federal government. The motivation to do this, however, was not there in the years immediately after the launching of the first satellites by the United States and the Soviet Union because of the bias toward more immediate profits as opposed to longer term gains. There was and still is the negative factor that the current practice of anti-trust law and policy(2) would in all probability prevent the construction of a consortium in the first place or lead to demands for its dismantlement after its establishment.

The economics of booster vehicle research, development, and application as exemplified by chemical rockets would in all likelihood be similar for other conceivable launch systems. An increase in management efficiency as a result of experience is to be hoped and expected for future launch system programs but sizeable financing should still be required. The political and economic difficulties of developing and launching private enterprise boosters has not completely hindered progress in this area. At least two companies have been organized in the United States to exercise a commercial launch vehicle capability. One company is Space Services Incorporated of Texas. The other company is Arc Technologies of California.(3)

The immediate motivation for the development of private sector launch capability is the anticipated demand for more remote sensing and communications satellites. Remote sensing satellites are generally placed in LEO while communications satellites are generally placed in geosynchronous earth orbit (GEO) which means that the initial private launch capability development is oriented toward the orbiting of remote sensing satellites because the capability of launching to LEO is much easier to attain than is a similar capability to GEO. There is at least one firm prepared to develop its own remote sensing satellite or satellites to be orbited by one of the private launch companies.(4)

Whether or not the current attempts at developing private enterprise launch capability are successful sooner or later some company will eventually succeed in this venture. The question then arises as to the need for a public policy with regard to private launch vehicle capabilities. The first step in the formulation of such a public policy has been taken in the introduction of legislation into the United States Senate by Senator Cannon which deals with the authorization and regulation of the launch of objects into the extra-terrestrial environment by nongovernmental entities.(5) Although this proposed public law deals primarily with the launch of vehicles it also states that it has the policy objective of furthering economic growth and private sector activity in the utilization of the extra-terrestrial environment.

A decision must be made as to whether to attempt to define public policy with regard to the entirety of extrepreneurial ctivities in the realm of the extra-terrestrial environment and space industrialization right at the outset or initially to confine such public policy definition to the narrow regime of private enterprise space launchings. This decision could be a matter of considerable importance in the real world in the sense of the making of precedents. There has already been considerable discussion of public and international policy and law with regard to the entire sphere of non-governmental extra-terrestrial activities.(6), (7)

A reasonable argument is to deal in terms of specifics. Although the benefits of space industrialization have already started to materialize in the area of commercial telecommunications and the potential benefits of commercial space industrialization in other areas can be known now in broad outline, legislation describing public policy and regulation for each of these areas should be enacted just before it seems that the potentiality is about to become a reality. In this manner, the legislation can be handled in a more realistic manner. This has been the case with respect to commercial communications satellites.(8) The first bill providing public policy and regulation for a specific area of commercial space industrialization was the Communications Satellite Act (CSA) of 1962. The proposed legislation of Senator Cannon, aside from amendments to the CSA of 1962, would be the second bill dealing with the policy and regulations of commercial space industrialization if it were to be passed.

There are significant differences between the CSA of 1962 and the proposed legislation of Senator Cannon.(5), (8) The CSA of 1962 filled a perceived need in that the benefits of a global communications satellite system were readily discernible although private enterprise within the United States was not considering itself to be in a position to secure those benefits.(9) The United States government also at that time did not consider itself to be in a position to act directly. Consequently, the CSA of 1962 directed that a public/private corporation be set up in order to attain the goal of the establishment of a global communications satellite system. In the area of launch systems, the situation is very different. The United States government has already demonstrated the feasibility of making launching objects into space a routine commercial venture. NASA for a number of years has provided launch services to the Communications Satellite Corporation (COMSAT) and to other telecommunications firms for the orbiting of communications satellites. It is the perception of some private entrepreneurs that American business can successfully wrest business away from the defacto government space launch monopoly.(3) It is a matter of time and effort determining when the private launch systems will be successful. Such a development will be healthy for American society since the private and government launch systems can be used as performance yard sticks for each other. An analogy to this situation would be the comparisons made between the Tennessee Valley Authority and the regulated private electric companies with regard to the service that both parties provide to the American public.(10)

The two main purposes of public policy in any specific situation are the promotion of particular interests and/or the promotion of the public interest.(11) The fulfilment of these two purposes simultaneously is not necessarily contradictory. It can be necessary to promote a particular interest in order to aid in the promotion of the public interest. The promotion of a particular interest can take several forms. It is usual to think of promotion of a particular interest in such terms as direct subsidies and protective tariffs. There are other actions which the federal government takes with regard to particular interests which actions are not usually as promotional but which support the particular interests indirectly. The setting of drug standards is a case in point. Such drug standards protect the health and safety of the public. At the same time, these regulations increase the confidence of the public in the products of the drug manufacturers.

The underlying basic relationships between the federal government and the private enterprise sector arise from the United States Constitution.(12) This document gives the federal government the power to encourage and to regulate commerce and industry while simultaneously restricting the powers of the individual states in this regard. In Article I, Section 8 of the

Constitution it is stated that the United States Congress is endowed with the power to regulate commerce with other nations, the states comprising the union, and the Indian tribes. Section 8 gives further regulatory powers to Congress in the laying and collection of taxes, duties on imports, exports, and manufactured goods, and excise taxes on commodities. The provision for the common defense and general welfare of the nation expressed in this section is another instrument of regulation. Further regulatory modes expressed in Section 8 are the power to coin money and to borrow it through the credit of the federal government, to regulate the value of said money and of foreign monies. The federal government is empowered to make uniform bankruptcy laws and to set weights and measures standards. The power to establish patent and copyright laws and to found post roads and post offices are also ways by which the federal government can affect the institutions and operations of the private section of the economy.

The potency of Section 8 is greatly enhanced by the clause which gives the Congress the power to enact all of the legislation which would be required to execute all of the above mentioned powers and any of the other powers given by the Constitution to the federal government or to any segment of that government.(12)

The concept of regulation as expressed in the Constitution can be interpreted in the broadest terms since regulation can be used to mean the determination and direction of any particular situation or situations in accordance with a system, rule, or principle.(13) Commerce in the sense of being any sort of business dealings also encompasses a very broad domain. Since in any conflict between federal law and individual state law, according to Article VI of the Constitution, the federal law replaces the state law, the realm of federal government controls has tended to expand with respect to the realm of state government controls.(12) The constitutional concepts of the support and promotion of the common defense and general welfare are of such an extensive nature as to readily justify the tariff policy of President George Washington and the use of federal government loans in recent years to save the Chrysler Corporation from destruction.

The treaty making and agreement making powers bestowed upon the federal government add an additional dimension to the commerce regulating abilities of that government.(12) The enforcement of any particular treaty allows the government to impose its will upon the business community with the limits imposed by the Constitution in order to assure that the business community acts in such a manner as to, if not aid in the enforcement of the treaty, at least, not act in a manner to obstruct the enforcement of the obligations of the nation with respect to its treaty partners. Within the context of a global technological society, there can, however, occur certain unlikely seeming situations as a result of the interaction between the powers of the federal government in the treaty making and commerce regulating domains.

For example, the United States is a member of the International Telecommunications Satellite Organization (INTELSAT). It is the Communications Satellite Corporation (COMSAT) established by the United States government which has been the main instrumentality which makes INTELSAT a viable and operational entity.(6), (8) It was not intended that the action of COMSAT in establishing a global communications satellite system should preclude its system from being used for domestic communications. COMSAT was placed under the purview of the Federal Communications Commission (FCC). The Secretary of State in the Communications Satellite Act (CSA) of 1962 setting up COMSAT is placed in an advisory relationship to the FCC. When the Secretary advises the FCC that it is in the national interest for commercial communications satellite service to be established at a foreign location including the emplacement of a satellite terminal station, it is then incumbent for the FCC to direct COMSAT and the relevant common carrier or carriers to provide such service. The FCC has the power to regulate the rates for public communications services provided by COMSAT so that these rates reflect economies of operation. As a consequence of these interactions, it appears that the FCC has exercised regulatory authority over INTELSAT. In the given circumstances, this is a legitimate authority even though the FCC is basically a domestic regulatory agency.

One case of particular interest to the American Jewish community of the power to regulate commerce on the international level was the response of the federal government to the boycott declared by the Arab nations against companies which had commercial relations with Israel.(14) The United States Congress passed legislation which was signed by the chief executive making the observance of this boycott by any American company an illegal act. While there were attempts to prevent the enactment of this legislation, there was no doubt in any quarter that the government did have the right and the power to act in such a manner.

The promotion and regulation of agriculture is a classic case of federal government intervention in the American economy.(11)The Patent Office obtained funds in 1832 to collect and distribute seeds, to pursue agricultural studies, and to acquire agricultural statistics. In 1862, the Department of Agriculture was created in order to provide services to farmers. In the same year, the Homestead Act was passed by Congress. This act opened up the lands of the Western public domain for settlement. Again, in 1862, the Land Grant College Act became law. This act gave free land to the states for the funding of colleges of the agricultural and the mechanical arts (A&M colleges). These colleges and the Department of Agriculture developed a cooperative system among themselves. More comprehensive agriculatural research by the federal government was provided for by the Hatch Act of 1887. This research became centered in the state A&M colleges.

With respect to the area of the development of the extra-terrestrial environment, the role of the federal government in encouraging, supporting, and stimulating the private sector of the economy has not been nearly as extensive in proportion as was the role of the federal government in the field of agriculture in the nineteenth century. It does seem somewhat contradictory. The field of agriculture is of such a nature that much more could be done by private enterprise sector than could be done at any equivalent stage by the private enterprise in the field of extra-terrestrial environment development. Agriculture in its earliest stages thousands of years ago could be undertaken by an individual or by a small group of people. The skills required were primitive and the technology involved was miniscule. The development of the extra-terrestrial environment requires the exertions of large groups of people with a wide range of skills utilizing a sophisticated technology.

The difficulty of opening up any new field of endeavour can be described in terms of a barrier to entry. In the case of agriculture, the barrier to entry was low with regard to making agriculture a field where the benefits obtained from it exceeded the effort and resources put into it. In the case of the development of the extra-terrestrial environment domain, the barrier to entry is high although the long-term benefits to be accrued will be enormous. The barrier to entry has already been breached in the subdomain of satellite telecommunications. It is significant that the successful entry into the era of communications satellites only occurred after the government of the United States had undertaken the accomplishment of the fundamental work that had to be performed.(9) It was as a result of an act of Congress that the mixed public-private corporation COMSAT was created.(8), (9) Judging from the hearings that were held prior to the enactment of the CSA of 1962, it is unlikely that the private enterprise sector of its own volition and through its own efforts could have attained anywhere the extent of success which has been attained by COMSAT.

COMSAT itself had to depend on the results of the programs of the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD). The launch vehicles which orbited the communications satellites were owned by NASA and were launched by the agency. The research and development for the operational communications satellites were basically performed by NASA with one significant contribution by Bell Telephone Laboratories in the form of the TELSTAR communications satellite.(7), (8), (9) The mixed nature of COMSAT was exemplified by the fact that its original stock issue was one third owned by the federal government, one third owned by private investors, and one third owned by the common carriers. Currently, hardly any of the stock is owned by the common carriers, more is owned by the government, and almost all of it is owned by private investors.(15) The only substantive connection between COMSAT and the federal government that now remains as compared to similarly regulated companies is the requirement that three of the members of the board of directors be appointed by the President of the United States.

Other areas of space industrialization will require the same kind of government-private sector interplay as has occurred in the field of satellite communications. In some areas, the federal government will have to be much greater. The next area of space industrialization to be commercialized may be that of remote sensing satellites.(16) To date, the remote sensing satellites as exemplified by the LANDSAT series has been basically a government development operation. There are plans now being proposed to provide for the transfer of remote sensing satellites operation to the private sector. This will be a difficult transition to accomplish. The transition will be dependent upon the perceived market. With the LANDSAT operations and data acquisition and distribution having been subsidized by the government, the market has grown. Without government subsidies, it is difficult to ascertain whether a viable market can be supported. There is a tendency on the part of LANDSAT data users to not want to spend more for data and services that they now obtain more cheaply from the federal government. If the private sector is going to charge more, then it must provide superior services.

In the long term, the most significant contribution of space industrialization will be the acquisition of raw materials from the extra-terrestrial environment for use both on this planet and in the extra-terrestrial environment itself.(17) This acquisition process will require a far greater governmental role than was involved in the satellite telecommunications area by orders of magnitude. This role will involve both direct and indirect actions.

By direct action by the government is meant government funded research and development and pilot and demonstration programs and projects. A suitable government project could be capture of an appropriate asteroid and the placing of this celestial object into an orbit about the Earth.(17) A small mining facility could be set up on this asteroid and the finished products then would be shipped to where they would be required. Such a demonstration asteroid mining project would require the expenditure of several billions of dollars over a period of years.

Another form of direct government action would take the form of loans. On a very small scale this sort of action is what was proposed in the unenacted Space Industrialization Act of 1979.(18) This act would have set up a revolving [illegible]

[illegible] arising from or manufactured in the extra-terrestrial environment. If the idea were to work out, then the company would return the money to the fund.

Direct government subsidy has been a traditional form of encouraging the development and growth of an industry.(11) The stimulation of the American merchant marine is an example of the use of subsidies. The Postmaster General was authorized by Congress to issue preferential mail subsidies to steamships that could be converted into warships. By 1858, however, these subsidies were discontinued because of financial difficulties a number of the steamship lines encountered. After the Civil War, these subsidies were again instituted briefly.

As a result of World War One, the United States created a Shipping Board in 1916.(11) This board then used its powers to create an Emergency Fleet Corporation. The final allocation of money made to the corporation was about three billion dollars with the goal of eighteen million tons of ships to be built by private contractors many of whom did not have any experience with ship construction. Less than a sixth of the projected tonnage was delivered before the signing of the Armistice and more than a third of the construction of the board fleet was begun after World War One. Overall, the operations of the corporation were inefficient and wasteful.

Prior to the onset of World War Two, the Merchant Marine Act of 1936 was passed.(11) This act replaced the mail subsidies with two types of direct subsidies. One subsidy was for the direct construction by the shipping interests while the other was for operations. The Maritime Commission was empowered to construct ships on its own initiative, and sell or charter them if the subsidy system proved to be inadequate.

Tax credits can be considered to be a form of indirect government action. In recent times, this type of action has been utilized to stimulate the development of solar energy by the private enterprise sector and the utilization of such energy by American citizens.

The legislation proposed by Senator Cannon is in the tradition of beneficial and constructive intervention by the federal government in the private enterprise sector of the American economy.(5) This legislation has two main objectives. The first purpose is to encourage and to be supportive of the development of private sector launch services. The second purpose is to provide assurance for the safety of the public and to satisfy the obligation the United States government has assumed under the space treaties which it has signed. These two purposes are related to each other. The provision of public safety by itself is an encouragement to the development of private launch services. The regulatory agency in this proposed bill is designated to be the Federal Aviation Administration (FAA).

A question can be raised as to whether or not the FAA is the appropriate regulatory agency. It might be more appropriate for a new agency to be created that would eventually be the instrumentality by which all private sector space activities would be regulated. Such a new agency would have the disadvantage of adding to the weight of the federal bureaucracy. It would have, however, the more than compensating advantage of emphasizing the significance of the opportunities and unique beneficial aspects offered by the extra-terrestrial environment.

Presumably the rationale behind making the FAA the regulatory agency is the fact that any object launched into the extra-terrestrial environment must first [illegible] object spends a finite amount of time [illegible] 1958.(14)

The allocation of responsibility for safety aspects of private satellite launchings to the Administrator of the FAA by the proposed legislation of Senator Cannon gives the Administration new responsibilities which would not be appropriate to the responsibilities given to the Administration under the original FAA legislation. Those original responsibilities are strictly in the domain of aeronautics.(19) A launch vehicle or rocket booster for satellites should not be considered to be an aeronautical vehicle subject to FAA regulation. If the FAA were to be required to regulate private satellite launchings then the original FAA legislation should itself be amended. This amendment would not be sensible because it would constitute a wedge which the FAA could eventually use for attempting to regulate other space industrialization activities as those activities would develop. Regulation of space industrialization activities by the FAA could constitute a hinderance to the development of such activities. The development of space industrialization is proceeding slowly enough already that it does not need further hindrances.

The preferred direction for regulation of private sector space industrialization activities to take is the establishment of an independent regulatory authority. Initially, this agency would regulate private satellite launchings. As further space industrialization opportunities unfolded, the authority would extend its regulatory domain. For example, the Fairchild Corporation is in the process of developing what it terms a Leasecraft.(20) A number of Leasats would be launched into orbit eventually to provide power and other services to other space industrialization facilities on a leasing basis. Regulations will be required from the points of view of safety and standardization. It would be appropriate for the independent regulatory authority to supply this regulation.

There is a definite need for the implementation in the immediate future of the regulation of private space launchings and, eventually, other private sector industrialization activities. The United States Congress should enact legislation as soon as possible providing for the establishment of an independent government agency to provide such regulation. In this manner, an orderly environment will be provided which will encourage an acceleration of the development of private sector space industrialization activities.

References

1. Van Nimmen, Jane and Bruno, Leonard C., with Rosholt, Robert L., NASA Historical Data Book, 1958-1968, Vol. 1:NASA Resources, (National Aeronautics and Space Administration, Washington, D.C., 1976).

2. Bork, Robert H., The Anti-Trust Paradox, (Basic Books, Inc., Publishers, New York, 1978).

3. Aviation Week & Space Technology, October 4, 1982, p. 17.

4. Aviation Week & Space Technology, October 29, 1982, p. 23

5. Private Satellite Launching Authorization Act of 1982, S.2448, introduced into the United States Senate on April 28, 1982 by Mr. Cannon et al.

6. Diederiks-Verschoor, I. H. Ph. and Gormley, W. Paul, "The Future Legal Status of Nongovernmental Entities in Outer Space: Private Individuals and Companies as Subjects and Beneficiaries of International Space Law," Journal of Space Law, vol. 5, nos. 1 & 2, 1977, p. 125.

7. McDougal, Myres S., Lasswell, Harold D., and Vlasic, Ivan A., Law and Public Order in Space, (Yale University Press, New Haven and London, 1963).

8. Space Law: Selected Basic Documents (second edition), Committee Print, Committee on Commerce, Science, and Transportation of the United States Senate, Washington, D.C., December 1978.

9. Communications Satellite Legislation, Hearings before the Committee on Aeronautical and Space Sciences of the United States Senate on S.2650 and S.2814, February 27, 28, March 1, 5, 6 and 7, 1962 (U. S. Government Printing Office, Washington, D.C., 1962).

10. Owen, Marguerite, The Tennessee Valley Authority, (Praeger Publishers, New York-Washington-London, 1973).

11. Fainsod, Merle and Gordon, Lincoln, Government and the American Economy, (W. W. Norton & Company, Inc., New York, 1941).

12. Mitnick, Barry M., The Political Economy of Regulation: Creating, Designing, and Removing Regulatory Forms, (Columbia University Press, New York, 1980).

13. Webster's New World Dictionary of the American Language, College Edition, (The World Publishing Company, Cleveland-New York, 1964).

14. Effectiveness of Federal Agencies' Enforcement of Laws and Policies Against Compliance, by Banks and Other U. S. Firms with the Arab Boycott, Hearings before the Subcommittee on Commerce, Consumer, and Monetary Affairs of the United States House of Representatives, October 20, 1976.

15. Annual Report to the Stockholders of COMSAT Corporation 1982.

16. Operational Remote Sensing Legislation, Hearings before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation of the United States on S.663 and S.875, April 9 and 11, 1979.

17. The Moon Treaty, Hearings before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation of the United States Senate, July 29 and 31, 1980.

18. The Space Industrialization Act of 1979, Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Technology of the United States House of Representatives on H.R. 2337, May 22, 23; June 26, 27, 1979.

19. Burkhardt, Robert, The Federal Aviation Administration, (Frederick A. Praeger, Publishers, New York-Washington-London, 1967).

20. Lowndes, Jay C., "Fairchild, NASA Agree on Leasecraft," Aviation Week & Space Technology, October 18, 1982, p. 14.